U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1724

Full Crew Interactive Simulation Trainer – Bradley (FIST-B): Limited User Assessment

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May 1998

U.S. Army Research Institute for the Behavioral and Social Sciences

A Directorate of the U.S. Total Army Personnel Command

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REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
May 1998	Final	August 1997 – April 1998

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Full Crew Interactive Simulation Trainer – Bradley (FIST-B): Limited User Assessment	5b. PROGRAM ELEMENT NUMBER 62785
6. AUTHOR(S) Margaret S. Salter	5c. PROJECT NUMBER A790
	5d. TASK NUMBER 212C
	5e. WORK UNIT NUMBER H01
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences Infantry Forces Research Unit, ATTN: TAPC-ARI-IJ P.O. Box 52086 Fort Benning, GA 31995-2086	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, VA 22333-5600	10. MONITOR ACRONYM ARI
	11. MONITOR REPORT NUMBER Research Report 1724

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT *(Maximum 200 words)*:

This report documents a limited user assessment of the prototype Full Crew Interactive Simulation Trainer – Bradley (FIST-B) training device. FIST-B provides a turret appended gunnery trainer linked to the engagement skills trainer (EST). Bradley squads can train selected squad level collective tasks together using the same computer-generated database. The assessment examined the capabilities of the FIST-B system through a series of user exercises. Bradley squads completed training scenarios, questionnaires and structured interviews. The FIST-B system had both strengths and weaknesses. An important factor in considering the results is the small sample size and prototype nature of the device. The gunnery (Mode I) portion of FIST-B had minimal testing as it mimics proven gunnery simulators. The value of squad collective training capabilities (Mode II), integrating the crew and the dismounts, was difficult to assess. Due to limitations in scenarios, constraints of the EST, and overall system reliability, the link of the crew to the dismount in movement to contact, attack, and defend scenarios was of limited benefit. For most squad collective tasks tested, the FIST-B and EST integration offered few advantages. The device, however, did show potential for integration of new personnel, and to build squad cohesion.

15. SUBJECT TERMS

Full Crew Interactive Simulation Trainer – Bradley (FIST-B); Bradley Fighting Vehicle (BFV); Bradley training devices

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	73	Scott E. Graham (706) 545-2362

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May 1998

Army Project Number
2O262785A790

Personnel Systems and Performance Technology

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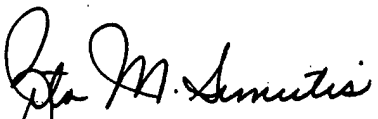
FOREWORD

This report describes the results of a limited user assessment of the functional capabilities of the Full Crew Interactive Simulation Trainer – Bradley (FIST-B) conducted by the Army Research Institute's (ARI) Infantry Forces Research Unit (IFRU) under the Work Package - Light Infantry Training Environments. The assessment was part of a cooperative research effort between ARI-IFRU and the Directorate of Training and Operations, U.S. Army Infantry School and Center, Fort Benning, GA. The assessment took place during three weeks of user exercises conducted with Active and Reserve Component soldiers.

This research was conducted to provide information on the FIST-B, a training device for Bradley Fighting Vehicle (BFV) personnel. FIST-B was funded by the Defense Advanced Research Projects Agency (DARPA) and developed primarily for the U. S. Army National Guard (ARNG). FIST-B was conceptualized as an inexpensive strap-on gunnery trainer to be appended to the turret of a stationary Bradley. Through computer-generated graphics, FIST-B provides realistic scenarios to Bradley crewmembers – the commander, gunner, and driver. As developed for the Guard, the prototype FIST-B device is linked to an engagement skills trainer (EST) device so the dismounted squad and the crew can train together sharing the same database. The integrated host computer provides both Mode I, Gunnery, and Mode II, Squad Collective Training.

The primary focus of this research was to identify the capabilities, strengths, and weaknesses of the device from the user perspective and to assess the capability of the FIST-B device to provide integrated training for the Bradley crew and dismounted infantry. The findings from this research have been provided to the U.S. Army Infantry School, to DARPA, and the ARNG.



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ACKNOWLEDGEMENTS

Although the author will take full responsibility for the content of this report, special acknowledgement is made of the contributions of others, without whom the FIST-B assessment could not have been conducted. In addition to the assistance provided by ARI colleagues MAJ Jim Reeves and Dr. Gene Fober, there were other personnel whose contributions were invaluable. SFC Steven Carpenter (Observer/ Controller), SFC Victor Dennis (Platoon Leader) and Mr. Edwin (Skip) Harnish (Instructor/Operator) made the assessment happen. SFC Joe Morris, SFC Lance Burdett, and LT Tom Hanley furnished support, as did all of our test soldiers. The assessment was a cooperative venture, and all are responsible for its success.

FULL CREW INTERACTIVE SIMULATION TRAINER – BRADLEY (FIST-B): LIMITED USER ASSESSMENT

EXECUTIVE SUMMARY

Research Requirements:

As part of a cooperative effort with the U.S. Army Infantry School and Center, the Army Research Institute's Infantry Forces Research Unit conducted an independent assessment of the prototype Full Crew Interactive Simulation Trainer – Bradley (FIST-B). The FIST-B device was developed by the Defense Advanced Research Projects Agency under the program Simulation in Training for Advanced Readiness, primarily for personnel in the U.S. Army National Guard (ARNG). FIST-B provides a turret appended gunnery trainer linked to a stand alone marksmanship trainer. Through computer generated graphics, a Bradley crew and its dismount element can train selected squad level collective tasks together using the same database. The user assessment was designed to explore the capabilities of the FIST-B system through a series of experimental user exercises.

Procedure:

In the first week a squad of ARNG Bradley personnel received training on the device and participated in a number of user exercises/training scenarios. They also completed questionnaires and engaged in structured interviews at the end of the exercises. Weeks two and three followed a similar format, with different groups of soldiers. The second week used a series of ad hoc squads composed of an ARNG Bradley commander, and personnel from other commands and backgrounds comprising the remainder of the squads. Week three used Active Component Bradley soldiers.

Findings:

The FIST-B system had both strengths and weaknesses. A key factor in considering the results is the small sample size and, more importantly, the prototype nature of the device. The gunnery (Mode I) portion of FIST-B was given only limited testing; gunnery training simulators have been fielded, and have proven value. The collective training capabilities (Mode II), integrating the crew and the dismount element, were more problematical. Due to limitations in scenarios, the constraints of the engagement skills trainer (EST), and overall system reliability, the link of the crew to the dismount in movement to contact, attack and defend scenarios was of limited value. The crew and the dismount element were training at the same time, in the same location, and on the same database, but in actuality the interactions between the crew and the dismount were minimal. For most of the squad collective tasks, the FIST-B and EST integration did not offer many advantages. The device, however, did show potential for integration of new personnel, and to build squad cohesion.

Utilization of Findings:

Data collected from this research will provide important information to trainers concerned with the potential for training integrated Bradley squads in simulations.

FULL CREW INTERACTIVE SIMULATION TRAINER – BRADLEY (FIST-B): LIMITED USER ASSESSMENT

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The Full Crew Interactive Simulation Trainer – Bradley (FIST-B) is a training device for Bradley Fighting Vehicle (BFV) personnel. FIST-B was conceptualized as an inexpensive strap-on gunnery trainer to be appended to the turret of a stationary Bradley, and through computer-generated graphics, provide realistic scenarios and gunnery targets to the Bradley crew members – the commander and gunner. The BFV driver would navigate through the computer-generated database and assist the crew in target identification and round count.

The FIST-B, designed specifically for the Bradley, is similar to a device developed for the Abrams M1 Main Battle Tank. A major difference in these two devices is that FIST-B, as it was developed in prototype, can also be configured to provide training scenarios for the dismounted Infantry element of the BFV. The FIST-B would then allow the BFV crew and dismounted element to train together as a squad on the same terrain on a simulated battlefield, providing mutual support.

The intent of this paper is to describe a FIST-B limited user assessment conducted at Fort Benning, Georgia. The assessment was planned to examine the training link between the Bradley crew and its dismounted element; the value of the FIST-B as a gunnery-training device was never in question. The assessment provided useful information and recommendations.

Background

The Defense Advanced Research Projects Agency (DARPA) has sponsored many advanced technology programs and served as advocate for simulation systems to be used for experimental application in the U.S. Army National Guard (ARNG). Many of these innovative training procedures and devices are found collectively under the program umbrella titled Simulation in Training for Advanced Readiness (SIMITAR). The overall intent of the SIMITAR Program was to leverage technology to alleviate some of training problems found in the National Guard. A very limited number of annual training days, coupled with the wide distances many Guard personnel must cover to get to training sites, makes efficient use of training time critical. The multiple devices provided by DARPA for the Guard have produced considerable benefits in both gunnery and maneuver training.

SIMITAR

Primary beneficiaries of the SIMITAR devices and programs include two of the ARNG Enhanced Brigades, the 48th Infantry (Mechanized) (GA), and the 116th Armor Brigade at Boise, Idaho. The latter, for example, regularly uses the SIMITAR sponsored SIMBART (simulation based mounted brigade training program) and SIMUTA (simulation based multi-echelon training program) battle staff synchronization training

support packages during SIMNET (Simulation Networking simulation) exercises. The enhanced brigades have also received the JANUS battle staff training simulation. These programs permit multiple training iterations to be conducted during a short time period through simulation. Other programs include variations on the Battle Staff Training System multi-media individual staff training modules; ARSI, a re-configurable maneuver simulator; and the pen-based electronics network for command information linking system (PENCIL) which provides computer-based message and graphic capabilities. Devices and programs are available for individuals, staffs, and for collective training, to include elements of a compressed gunnery strategy. (See Burnside, Quinkert, Black and Maggart, 1995; Burnside, Leppert and Myers, 1996; Andre' and Salter, 1996; Pickell, 1997; Hicks, 1997; and Harber, 1996, for more detail on the overall SIMITAR Program.)

The A-FIST. To enhance gunnery training, DARPA and the National Guard have worked extensively with the 116th Armor Brigade in utilization of a number of devices and simulations. They include a gunnery training device for the M1 Abrams tank, the Abrams Full Crew Interactive Simulation Trainer (A-FIST). The A-FIST is based on the original GUARDFIST-I (Guard Unit Armory Device Full Crew Interactive Simulation Trainer), the result of a 1987 training device requirement which was intended to assist National Guard units in preparation for gunnery. Guard units, already constrained in training days, have few gunnery ranges, and their vehicles are not always co-located with or even near to the soldiers who must use them for training. A-FIST was planned as a tank-appended computer simulation training device for collective crew maneuver and full gunnery training. (For additional information on A-FIST, refer to Test and Experimentation Command, 1995; Logan, 1997; Snyder, 1996; STRICOM 1997c, 1997d.)

Overall, the A-FIST device has received positive marks for training tank gunnery. It contributes to precision and degraded mode gunnery training by requiring the same techniques and procedures as full caliber gunnery. A-FIST has a progressive gunnery matrix similar to the already fielded Conduct of Fire Trainer (COFT). Armor units like the fact that A-FIST includes the commander and gunner, the loader with dummy rounds, and the vehicle driver seeking cover and concealment through the terrain database. A training strategy might include maintenance, individual tank skills, SIMNET maneuver training, COFT precision gunnery and platoon gunnery on four A-FISTs.

The Bradley -- linking the dismount and the crew. In view of the apparent success of the A-FIST device for a low-cost full crew simulation of tank gunnery, a device was planned to provide a similar benefit to the Mechanized Infantry force. Unlike the tank, in addition to the Bradley commander (BC), gunner and driver, the BFV carries Infantry dismount soldiers in the troop compartment. While several devices provide crew gunnery training, others provide rifle marksmanship training, and still others provide practice in maneuver or command and control, there are none available to provide a training link between the crew and the dismounted element. This has been a problem since the Bradley was fielded in the early 1980s.

The Fighting Vehicle Infantry Military Occupational Specialty (MOS) 11M focuses on the vehicle, gunnery and related maintenance skills, and the MOS 11B Infantry skills required of the 11M Dismounted Infantry element are often overlooked, and receive little training time. This problem is even more severe for National Guard personnel with only 39 days in a year to train, and personnel from the entire vehicle rarely train together. Typically the crew trains for gunnery on the vehicle or in a simulator, while the dismount element trains individual gunnery and maneuver skills at another location. It was hoped that the FIST-B crew gunnery device could provide scenarios that would provide a link to the dismounted element of the Bradley.

Prototype FIST-B. In March 1996, again under the DARPA SIMITAR initiative, a contract was awarded to RAYDON, Inc. of Daytona Beach, FL, to develop the FIST-B device for the BFV. The FIST-B is a one of a kind prototype with a small number of computer-generated scenarios. The FIST-B, appended to the BFV turret, allows Bradley crews to practice gunnery, while an attached engagement skills trainer (EST) provides the Bradley's dismounted soldiers the opportunity to train in the same virtual battle space as the vehicle (Meadows, 1997). The prototype FIST-B device was fielded in March 1997 to the Mechanized Infantry units of the 1/163rd Infantry, Montana ARNG.

As detailed in an early fact sheet from the U.S. Army Infantry School (USAIS), the FIST-B permits the BC to guide his squad through a virtual situational training exercise (STX). The BC controls the crew and dismount element. Graded scenarios are based on completion of the mission, engaging the enemy, and safely firing the BFV weapon systems in coordination with dismounted elements. The BC receives instructions from the Platoon Leader or battle master at the Instructor/ Operator (I/O) control station (Hanley, 1996).

The contractor's FIST-B Trainer Handbook notes that the FIST-B is "designed to train and sustain Bradley and dismounted infantry engagement skills, command and control, coordination of fires, and communication skills critical to the successful mission accomplishment of the Mechanized Infantry squad" (Raydon, 1997, p. 1-1). It further claims "realistic challenging Bradley precision gunnery tasks, infantry precision marksmanship training, and combined mounted and dismounted tactical coordination and target engagement skills training" (Raydon, 1997, p. 2).

Description of FIST-B

As developed for the Guard, the FIST-B device consists of the apparatus mounted on the turret of a standard stationary Bradley, an engagement skills trainer (EST) device, an I/O station, and an integrated host computer and image generator. The computer provides system synchronization and timing, and controls the training system during Mode I, Gunnery, and Mode II, Squad Collective Training. The dismounted squad and the crew share the same database and sophisticated computer-generated graphics.

The image generator provides full color, high resolution computer images through the periscopes and vision blocks of the Bradley crew (BC and gunner), and through the driver's vision blocks. The visuals are displayed at the turret, on the EST viewing screen, and at the I/O station monitors. The visual database simulates an area five kilometers deep by eight kilometers wide, with trees, rocks, hedges, buildings, roads, etc., in European and desert environments. The visual scenes are projected to the BC and gunner sights in four and twelve power, and in single power to the BC's forward and right front unity vision blocks, and the driver's forward, right and left front vision blocks. The dismounted element scenes are projected on two 10' wide by 7 ½' high viewing screens. Single or multiple vehicular and aerial targets appear at ranges from 150 to 3600 meters. Targets include troops, RPG teams, trucks, BMPs, HIND-Ds, tanks, etc. Troop targets appear as stationary flashing red lights in Mode I (like in the COFT); in Mode II, they are stationary or moving on a preset path with speed of movement consistent with running troops. The audio system provides aural cues that represent engine speed, steering, vehicle movement and weapons firing. Sound is transmitted over vehicle radio/intercom and heard through CVC (Combat Vehicle Crewman) helmets and EST loudspeakers. (Further technical information is found in Raydon, 1996 and 1997.)

Mode I (Crew Gunnery). Mode I provides gunnery training that is very much like the already fielded COFT with special purpose, gunner/commander, commander only exercises, variable visibility and friendly and enemy fire. A progressively difficult training matrix guides gunnery. Mode I can provide basic, certification and sustainment training. An I/O operates the equipment and serves as instructor, using knowledge of gunnery principles, and techniques of mounted and dismounted operations. He observes monitors that provide the BC, gunner, driver and dismount viewpoints and computer print outs of performance data. The I/O prepares the crew for training, conducts debriefings and After Action Reviews (AARs).

Mode II (Squad Collective Training). Mode II provides the integration of the dismounted Infantry and the crew, and provides collective training and gunnery in a simulated closed hatch mode. Mode II uses a free play scenario with multiple target opportunities for the crew and the dismount element on adjacent portions of the terrain database. The dismounted element practices gunnery skills through links to the already-fielded Engagement Skills Trainer (EST), in this case the commercially available EST designed by FATS, Inc. The FIST-B simulates vehicle movement through exercises and scenarios in a realistic battlefield environment. The BFV and the dismount element see the same screen and engage targets together.

Troop compartment personnel dismount when dismounted Infantry targets or missions are available. At the BC's command, the squad exits the vehicle through the open ramp and moves tactically to a dismounted firing line or area where the computer generated scene is displayed to their front. In an ideal situation, the squad is able to assume prone firing positions. Simulated weapons include the M16A2, 5.56mm rifle; M249, 5.56mm squad automatic weapon (SAW); M203, 40mm grenade launcher; and the M136 AT4, 84mm Rocket Launcher.

Mode II relies heavily on the attributes of the Engagement Skills Trainer (EST). The EST was designed to provide a unit/institutional indoor, multipurpose multi-lane marksmanship trainer and collective trainer for small arms, crew served and individual anti-tank weapon systems. A secondary purpose was to provide collective tactical training for static dismounted Infantry, Scout, Engineer and Military Police Squads. The EST can train leaders of fire teams and squads in command, control and distribution of fires while in a realistic collective mode (STRICOM, 1997c, 1997d).

Problem

The A-FIST has been validated as a gunnery trainer. The FIST-B is reported to train gunnery skills like the A-FIST and as well as or better than the COFT, but unlike the COFT, uses a real vehicle. The own vehicle v stand-alone simulator (whether Unit or Mobile COFT) has surfaced as an issue for the National Guard because although units like the COFTs for gunnery, the Mobile COFTs are frequently inaccessible for training. The FIST-B device could provide COFT-like gunnery using a real vehicle. An additional benefit would be crew/dismount interactivity and squad training through the FIST-B and EST linkage.

Because there is only one FIST-B device, information on the FIST-B has been limited and potentially false expectations have been raised. A further complication lies in the fact that the term FIST-B is used to refer to the turret appended device alone *and* to refer to the turret appended device *plus* the EST. Overall issues include what the device will train, who would use it, costs, tradeoffs, and possible redundancy with other devices. Some say that the device is all inclusive, one that can train the entire Bradley squad on most tasks. Others acknowledge that there are skills trainable in the FIST-B that are not trainable in other devices, but they do not state which tasks can be trained. Still others have briefed the device based on what it might or could look like in a fielded mode, on what the device, if improved, could offer to the mechanized infantry community. Early demonstrations of the FIST-B included the AUSA Conference, October 15 –19, 1996 and a November 13, 1996 briefing at Fort Benning.

The Assessment

A limited user assessment was conducted to determine the overall utility of the FIST-B device (turret appended FIST-B plus EST) for active and reserve component squad level collective training, i.e., Mode II. It was understood that the sample size (3 squads) was far too small to provide conclusive data, that the prototype device would only slightly mirror the capabilities of a fielded device, and that the scenarios available were limited. However, it was felt that there would be sufficient data to indicate the value added for collective task training provided by the FIST-B/EST link up. The assessment was conducted jointly by the Directorate of Operations and Training, U.S. Army Infantry School (USAIS), and personnel from the Army Research Institute (ARI) at Fort Benning. USAIS formulated and resourced the plan, and provided subject matter expert (SME) support to assist test troops in use of the FIST-B device. ARI developed

questionnaires and conducted structured interviews with test soldiers. The test ran from September 22 through October 9, 1997.

Purpose

An early statement of the intent of the test came in a June 25, 1997 Memorandum that detailed the planned assessment of the training value of this simulator across a broad spectrum of tasks. "As a result of this assessment, training applications for FIST-B at the institutional and/or unit level for both active and RC forces will be determined" (Hanley, 1997a). An August 13 restatement of purpose was "to evaluate and document the unique collective training tasks the FIST-B is capable of providing (BFV crew and Infantry squad collective training and interaction) in order to provide comparison and contrast to existing simulations for ARNG specific and Total Army training" (Hanley, 1997c, Slide 2).

Procedure

Contractor site visit. In July 1997, a six-person USAIS/ARI went to the contractor's facility to become familiar with the device. Contractor personnel were available to answer questions, and to benefit from military SME assistance. Primary on-site help was on scenario development and weapons characteristics. Further feedback was provided to the contractor in early August, outlining prioritized technical "fixes." A description of desired scenarios and the required link between the BFV perspective and the EST infantry perspective was provided; other information focused on ballistics, round impacts, and tracers (Hanley, 1997b).

The FIST-B was demonstrated at the Pentagon in August 1997, and in early September at the National Guard Conference in Albuquerque, NM. Three FIST-B team members attended the Conference, and gained further information on the capabilities of the FIST-B, and the requirements for setup, takedown, maintenance and storage.

Test site preparation and logistical support. Prior to the assessment, USAIS SMEs arranged logistical support, and prepared the facility. The FIST-B uses an actual Bradley and requires a large indoor area. The area must have sufficient height and floor space to accommodate the vehicle and to evaluate the EST-Bradley linkage, sufficient maneuver area for the dismount personnel and the EST screen. It also required a bay type door through which to drive the vehicle.

A building in the Fort Benning Harmony Church area was used for the test. It was selected because it met the building requirements, and the Engineers who owned the building were willing to allow the test to be conducted there. The site met electric power requirements, and had available several secure areas to store sensitive items. The few windows were small, and could be covered to accommodate the FIST-B low light requirements. The doors, including the bay, could be closed, with minimum light

entry. The building was not air-conditioned. The light requirements and lack of cooling caused personnel and equipment problems during some extremely warm days.

Before the device arrived, the USAIS SMEs spent several weeks preparing the building. This included construction of a firing platform placed in front of the area where the two ten-foot EST screens were to be located. This raised platform, constructed of lumber and green indoor/outdoor carpet and logs, was designed to give the overall appearance of a firing line. Access was by a wide ramp with a very slight incline. Each gunner's position was evident by the location of the EST dismount weapon. The platform was raised to permit the cords and wires associated with the EST to be located out of the way, below the platform, and to camouflage the view of the EST computers and CO2 bottles. Leaves and small branches were added to camouflage nets to further increase realism. Several long logs at the front of the platform could be used to support weapons. The intent was to provide prone firing positions, although the AT4 gunner and the grenadier usually rose to a knee when they fired.

The Bradley, fixed in location because of the requirement to share the building, was located immediately to the right of the I/O station (see Appendix A for photographs). The EST screen and the platform were at an angle to the vehicle, to the left of the I/O station, in actuality, only about 10 feet away from the ramp. The Bradley was at all times stationary, with the ramp down. The turret could not be traversed because of FIST-B electrical wires.

In addition to the vehicle and FIST-B accoutrements, other equipment was available. Tables and chairs for observers and AARs, and an easel and map board for pre-briefs were provided. Empty EST M16 rifle magazines were available so the dismount could reload. Since test personnel did not have their actual weapons, replicas, so-called "rubber ducks," were provided for the dismount element to carry into and from the Bradley. The squad leaders wore CVC helmets within the vehicle to maintain communication with the turret and relied on a radio when dismounted.

Scenario development and capabilities assessment. As noted earlier, USAIS trainers, SMEs on Bradley and Infantry tasks, assisted in the preliminary development of the FIST-B scenarios to ensure that collective (turret and squad) tasks would be replicated. The plan to develop scripted scenarios suitable for evaluation of collective tasks and dismounted infantry skills, and to develop task checklists was only limited in its success. A formal comparison of FIST-B capabilities to those found in existing BFV training devices and simulations did not occur.

Methodology - Limited User Assessment

An August 25, 1997 Memorandum of Instruction was sent from the USAIS to personnel supporting the test. It stated: "The purpose of the FIST-B assessment Program is to evaluate total Army training applicability of the FIST-B training device to support proposed Army National Guard (and possible Active Component) procurement/ fielding strategies" (Hanley, 1997d). Accomplishment of this very ambitious objective,

with a limited number of personnel and in a very constrained time period, made some rules of engagement mandatory.

The building selected met the requirements for the device and for the Bradley but an additional benefit was its location far from the main post area of Fort Benning. The location made it difficult – or at least inconvenient -- for visitors to get to the test site. A decision was made very early on to maintain a closed test site. Considerable information and misinformation had already been disseminated about FIST-B, and the likelihood of well-meaning persons interfering by talking with the test soldiers was rather high. Part of the plan was to interview test soldiers at the conclusion of their FIST-B experience, to gather their opinions on the device and the training afforded to them. We did not want other people's opinions to be substituted for theirs. Therefore to maintain the non-biased test site, with the exception of the engineers who owned the building, only test personnel were permitted inside.

The USAIS plan. The original plan called for Phase 1 where a task selection panel decided which 11M tasks would be used to assess the FIST-B. This drove preliminary site choice, set-up, systems checks, and key personnel train-up. Phase 2 was the hands-on evaluation, using both active and reserve component 11M soldiers "to determine which tasks if any can be trained to standard using this device" (Hanley, 1997a). Phase 3 was data analysis and Phase 4, final recommendations based on the data. Final procurement of the FIST-B would be based on the device's applicability as a part of the mechanized infantry platoon training strategy.

The plan called for three weeks of testing, with one week each focused on personnel from the active (AC) and reserve components (RC), and one week for ad hoc crews and squads. Both the AC and RC were to provide a stabilized crew with its own battle-rostered dismount team; the ad hoc AC/RC mixed crew with dismount team would represent cross training or destabilized section training. Stabilized crews and dismounts with standing operating procedures (SOPs) would provide good indications of training value of the device. The schedules were planned so troops reported on Monday for briefings, train-up on the device and overall familiarization, followed by the MTC, defend and attack scenarios. At the end of each segment of training, or at the very least, daily, AARs would be conducted.

Data collection plan. ARI developed data collection instruments. The Demographic Questionnaire (Appendix B) was the first instrument completed by each test soldier to ascertain military and civilian education, and experience with specific training devices. Questions also included computer use and games familiarity to help determine soldier comfort with simulations.

Another form was the Infantry Crew/Team Assessment (Appendix C) designed to determine test soldier impressions of the realism of the device and its training effectiveness. Ratings included feedback on communications, aiming and firing the weapon, and on identification of sectors, adjusting fire, difficulty of engaging targets, etc. This form would be administered twice to each soldier, once early in the training and

then later after they had had more experience with the device. An observation sheet was available to record performance data and other events that occurred during each day's training. It could also be used to make notes on utilization of the device, exercise sequence, and the visibility, order of exercises, etc., as well as the length of time between exercises.

A final instrument was used to provide leads for structured interviews (Appendix D). The questions, asked to individuals or small groups, depending on the situation, asked the soldiers for their opinions on the best features of FIST-B, any attributes that need improvement, and how well they could perform the Infantry tasks of move, shoot, and communicate. Questions were asked about individual and collective tasks that can be trained using FIST-B, about realism of the scenarios, the databases, and the whole experience. They were also asked how they would use the device in their own unit if they were the primary trainer, and whether it should be moved from one location to another or left in place.

Computer-generated printouts. A final source of data came from the FIST-B computer. The FIST-B, like the COFT, provides soldier performance information at the end of each scenario. Although printing is optional, for training purposes it is mandatory. Each printout (see Appendix E) contains the exercise number, the date, and other identifying information. The Situation Monitor lists targets for each scenario, their range, etc. A designator shows whether the target was for the crew or the dismounts. Miss, hit and kill data are provided. The Crew Performance Analysis shows time to identify vehicle targets, time to fire the first round, and numbers of targets (vehicles and troops) presented and killed. The Squad Summary shows the numbers of rounds, hits and kills for the crew, and for each of the six firing stations, by lane position.

Tasks to be evaluated. In providing data on the FIST-B as used for integration of the turret and the dismount element, the overall intent was to evaluate as many as possible of the collective Infantry ARTEP (Army Training and Evaluation Plan) tasks. (See USAIS, 1997.) Although several tasks were not specifically looked at, it was taken as a given that they could be done in conjunction with FIST-B training. There was no need to spend training or testing time on practice of tasks that although possible while in or near the vehicle, do not need to be accomplished there. ARTEP tasks Prepare for Combat (7-3/4-4605), Consolidation and Reorganization (7-3/4-1607), and Develop and Communicate a Plan (7-3/4-606) are examples of tasks that could have been but were not evaluated. They do not require the vehicle or a device.

Similarly, since all of the descriptions of the FIST-B promised Mode I gunnery identical to the COFT in matrix movement rules, ballistics, etc., but with better graphics, there was no need to evaluate the crew gunnery capabilities per se. If the turret-appended part of the FIST-B is as good as or better than the COFT, it is presumed adequate. The primary intent was to look at Mode II, maneuver or combat gunnery, where the focus is on the integration of the turret crew and the dismounted element. In accord with the USAIS plan, the SMEs were to evaluate the performance of tasks and subtasks as described at Table 1.

As noted earlier, although the crew was engaging targets with the M242 25mm, the M240C coax and the TOW as well as performing concurrent tasks of target identification, issuing and responding to fire commands, perform misfire procedures, these tasks were not formally evaluated. Similarly the individual tasks involved in firing the dismount weapons (the M16 rifle, the SAW, the grenade launcher and the AT4), were not evaluated per se. Hit and miss performance was relevant only in so far as it gave information on collective tasks such as fire distribution and control. However, the I/O and the SMEs did provide feedback as appropriate in these areas, both on the spot and during AARs. Several leader tasks could be only partially evaluated. These included, for example, select overwatch positions, control organic fires, control movement of fire team, conduct maneuver of a squad, and navigate mounted.

Table 1

ARTEP Tasks to be Evaluated

Movement to Contact which includes	(7-3/4-4101)
Move tactically (mounted)	7-3/4-4134
Take actions on contact	7-3/4-4107
Perform actions at danger area	7-3/4-4135
Employ direct fire weapons systems	7-3/4-4201
Employ fire support	7-3/4-4200
Execute Defense which includes	(7-3/4-4115)
Employ direct fire weapon systems	7-3/4-4201
Employ fire support	7-3/4-4200
Execute defense	7-3/4-4115
Defend against air attack	7-3/4-4301
Move tactically (mounted)	7-3/4-4134
Execute Attack which includes	(7-3/4-4100)
Move tactically (mounted)	7-3/4-4134
Employ direct fire weapon systems	7-3/4-4201
Employ fire support	7-3/4-4200
Perform overwatch/support by fire	7-3/4-4108

Note. Adapted from USAIS, 1997 and per Hanley 1997c.

Test personnel. Test personnel were military and civilians. Two senior USAIS instructor cadre SMEs were on site full time; two others were available part time. All were MOS 11M, and three were Bradley master gunners, well experienced with the BFV and its training devices. The I/O, a civilian assigned to the 29th Infantry Regiment Bradley Proponency Office, is a former tank and Bradley master gunner. Two officers from USAIS also played a large part in the preliminary portions of the assessment, but because they are National Guardsmen, they stayed away from the test site to preclude claims of conflict of interest. An ARI officer was present throughout and two ARI civilian research psychologists served as independent observers.

Two other groups were on site. In Week One, the contractor provided two people -- a software engineer and a retired Armor officer trainer who was new to the

device. In the second week, an engineer with considerable experience in programming and with FIST-B was present. The third week representative was a marketing person who, though prior military and experienced with FIST-B, was less skilled in equipment diagnostics. The second group was the engineers who retained free access to their building, supported the test where possible, and during the ad hoc week, served as squad members and assisted in test firing weapons.

Daily schedule(s) and procedures. On the first day, the test soldiers were to be briefed on the FIST-B, the purpose of the test and on the overall schedule for the week. Administrative announcements and the demographic questionnaire would be distributed, followed by preliminary practice on the equipment. The remainder of the week would be broken into morning and afternoon sessions consisting of pre-briefs, selected exercises, AARs, and twice, the User Assessment Questionnaires. The final day was to include structured interviews. By allowing a full week, each of the different scenarios, visibility conditions (day through dusk and night, with snow, fog and rain) and both European and desert terrain databases, could be fired several times. Both baseline and post-training performance data could be obtained.

Results and Discussion

Test soldiers were evaluated on their ability to use the device, the perceived training value of the device, and on their performance of selected tasks. As noted previously, it was acknowledged that the sample size was so small and the time so short, that any findings could be regarded only as provisional. In actuality, the limitations of the test proved more severe than expected and maintaining momentum was very difficult. Technical problems and personnel changes caused complications. There were positive indications of training transfer, but the problems encountered make results tentative, even though the directions were clear.

Test Soldiers

We had requested intact squads with battle-rostered crews. The National Guard personnel were, as requested, all 11M MOS. However, they represented several platoons, and not a true squad. The BC was the platoon sergeant with a new gunner; the squad leader had worked with only two of his dismount element. The SAW gunner had only ten months Army experience.

The ad hoc groups in the second week were, as expected, of varying MOS and experience levels and the composition of the squads changed often. Part of this was by design, part because of planning problems. This meant that some persons were available for only half days, or parts of days. The only constant was an ARNG Lieutenant who served as BC all week; his gunners varied. On the first two days he had to train an engineer on basics such as turret controls. Another gunner, a former 11M but recently at Fort Benning's Ranger Training Brigade (RTB), was once a competent gunner, but now very rusty. The third gunner, a master gunner, was selected from the test cadre when no one else was available. The ad hoc squads varied also. The first

few were the engineers; later groups came from the RTB. One was from HHC (the XO and several of his staff, all MOS 11B, but somewhat out of practice on Infantry squad skills). Another group from RTB was comprised of a company commander, his first sergeant, and two others. These personnel were inexperienced with the BFV, but very, very good at basic Infantry skills.

On the first day of the Active Component testing, onsite personnel were MOS 19D scouts, not 11M Infantry. On the next day, several 11M arrived to fill in. They were from different platoons, and learned to work together, but were in no way a battle rostered crew or a stable squad. The BC and gunner were 11M with a new driver.

The personnel turmoil and indeed turnover as some people who came in the morning inexplicably did not return, or came one day knowing they were unable to be there the next, impacted in several ways. First, we do not know if results would have been different if we had had intact squads with SOPs in place, where the dismount personnel knew each other and their capabilities. Secondly, the effort to sort out the players, both in the ad hoc week, but especially in the active duty week, wasted considerable training time. Whenever a soldier did not come back the next day, we lost irreplaceable data. In effect, after the first week, all squads were ad hoc squads.

We saw approximately 40 soldiers. Demographic data were unavailable for many. Performance data were available, but since squads varied, data cannot be linked to specific personnel. Questionnaires were administered where possible, but not as planned. On average, the ARNG personnel were older than the other groups (32.5 v 22), and the extremes of time in service, 22 ½ years to ten months, were the ARNG platoon sergeant and private. All were high school graduates; only a few had any college. All RC personnel were 11M, the AC were 11M and 19D, the ad hoc another mixture. There was only limited familiarity with any of the devices, except for the COFT which most 11M and 19D had used for gunnery training. A few individuals reported SIMNET experience; some ARNG were familiar with the EST used as a marksmanship training device. Self-reported marksmanship qualification scores were mostly sharpshooter.

Test Site and Equipment Considerations

Some equipment was unavailable or arrived late. Only the RC soldiers brought protective masks; thus only they were able to fire in the NBC mode. No one in the ad hoc squads brought helmets; for safety they could not mount and dismount the vehicle in the standard manner. No one had night vision goggles; only the crews (BC and gunner) could "see in the dark." The EST dismount weapons are fixed in place. Soldiers need to carry weapons when they dismount and remount the vehicle but no real weapons were available and the replicas arrived late. The constraints of the building and the prototype equipment forced the BFV and the EST screen to be in close and fixed proximity. The dismount element could exit in only one direction, always to the same place. They were aligned in a straight line, and when there were six soldiers in the squad, they were nearly shoulder to shoulder.

The Scenarios

The OPORD (Operation Order) (given by a SME at the start of training) said the unit was to establish hasty defensive positions, seizing key terrain to facilitate future attacks against an attacking force. All scenarios included opportunities for the troops to dismount the BFV, fire at enemy troops (crossing from one side of the woodline to another, coming from helicopters or trucks or from behind buildings) or at vehicular/aerial targets (BMPs and helicopters). One scenario involved dismount at a bridge and destruction of enemy troops in front of the bridge and in the water. Hasty defensive scenarios permitted the squad leader to assign sectors and the squad to make range cards. The dismount element reported back to the vehicle and at the conclusion of the scenario, remounted.

One of four basic exercises used was a military operations on urban terrain (MOUT) demonstration exercise (Number 442211) which provided dismounted targets within 100M. This scenario (called the "shooting gallery demo") provides numerous targets (many more than would be realistic), most for the dismount element. The other three primary exercises were Movement to Contact (Number 451312) followed by Hasty Attack (Number 452312) and Defend (Number 483110).

The overall intent was to repeat the same exercises several times for each squad, to note performance improvements, etc. The basic set which included the MTC, defend and attack exercises would be interspersed with other exercises from the FIST-B scenario library, and visibility and weather conditions would be varied to preclude boredom, too much familiarity with the exercises, etc. However, especially during the first week, this was not possible. The three main exercises and the MOUT demo were the only ones that worked reliably. Several scenarios were inoperative or "crashed" repeatedly, and the desert database could not be successfully loaded. Additionally, the ambient light in the building precluded dusk firing for the dismount element. Rain appeared almost identical to day visibility. Without night vision goggles, only the crew could use the night mode, through the thermal sight. In sum, only four exercises could be used on a regular basis, on the European terrain, and under daylight conditions or in snow. Table 2 shows numbers of each of the exercises completed for each group.

Although there was sometimes another Bradley (the wingman) visible on the screen, it did not fire or appear to provide support. Occasionally the dismount element could see their own Bradley; more often, it appeared that the crew engaged targets in their own scenario while simultaneously but independently, the dismounts engaged theirs. Additionally, the enemy reacted to friendly fire, but did not fire back. The FIST-B troops could not be killed. In practice this translated to a series of short exercises, characterized by a stop and go pattern. When the troops were mounted, they rode with no activity; when they dismounted the targets were already up, or almost up. They fired repeatedly, in intense bursts, then remounted the vehicle, at which time the exercise terminated.

Table 2

Exercises Completed by Each Test Group

Exercise #	ARNG	Ad Hoc	Active	Comments
423312	4	4	3	MTC like 451312 trucks troops bridge
442211*	3	7	9	MOUT demo
451312*	6	4	4	MTC bridge with troops in front and in water
452312*	0	2	7	Attack
453312	3	0	0	Troops exit chopper behind houses, targets out of range
483110*	5	0	6	Defend
498312	4	2	0	MTC like 451312 w/o choppers

Note. Starred exercises were most reliable and most used.

Data Collection and Soldier Performance

The data collection team (ARI, USAIS NCOs, and the I/O) was on site to observe FIST-B training at all times. We kept running records, including dismount/remount times, ammunition reloading, problems with the system, good and bad examples of soldier performance. We attempted to be systematic by planning the scenarios in advance, and by executing them in a predetermined order. This did not always happen.

Although the overall intent was to show the interactions between the turret crew and the dismounted element, this entire area of evaluation suffered because the BC was unfamiliar with the scenarios, and could not tell when he needed to have the troops dismount. As the scenario unfolded, it was very difficult for the BC to know what was going to happen, and he did not know what to tell the squad. The BC was dependent on external input from the NCO who served as the platoon leader. As a situation was about to occur, the platoon leader had to cue the BC to do something, to let him know in advance of activity requiring the dismounted element to be on the ground. The BC was thus always reacting, rather than coordinating or planning in advance. He was not in a decision-making mode.

Additionally, since the squads had not worked together before, they had no SOPs to govern or guide their behaviors. The observer/controller (O/C) who was monitoring the dismount performance made notes, and provided feedback as appropriate. Over time we saw improvements in many areas, but only where the O/C had specifically provided critiques. Both the BC and squad leader were busy with the short-term fight, and could not see the entire picture. Only the external observers (the I/O, the platoon leader, and the O/C) were actually observing performance; everyone

else was fighting. This meant that unless specifically corrected by the external observers, the squad made errors. The external observers, not the squad, were the only ones able to see what was happening. The crew and the dismount were training together in space and time, but were not truly as a squad.

In discussion of the capabilities of the FIST-B, it is very difficult to separate out the device from the soldiers using it. Clearly, if the O/C had been the unit's primary trainer, he would have applied corrective actions immediately when he observed incorrect procedures. For the purpose of the assessment, however, we permitted the behavior to continue without interference. We wanted to see if there was anything about the device per se that would help the soldiers, or that would provide value added to their training. We wanted to see the soldiers train as a squad, to see if their interactions and performance on collective tasks were facilitated by the FIST-B.

Results of the data collection and observations are discussed below. The ARTEP tasks are discussed first followed by gunnery, then test soldier ratings, specific issues, and interview comments.

Collective Tasks – ARTEP Tasks

During the assessment, the USAIS SMEs were to observe the training, and note if the ARTEP tasks could be done, or were done, to standard. Each task is comprised of subtasks, and they could evaluate or grade the subtasks, as would be done during a field exercise. However, the grading was somewhat informal and no training and evaluation outline (T&EO) rating sheets were completed. In addition to the observer data sheets which contained considerable information, an after test assessment was performed by the military personnel. The overall consensus is shown in Table 3.

Move tactically. As noted, each task is comprised of subtasks. Move tactically consists of map reconnaissance followed by movement over a concealed route, using designated movement techniques. Formations are adjusted, squads move by bounds, provide overwatch and maintain security. Although some subtasks could be performed in FIST-B, most could not. Currently, the BC must follow specific vehicle paths through the database; little variation is possible or targets will not be visible. Only one route is possible and the BC cannot independently plan or conduct a map reconnaissance. The vehicle commander can, using his driver, move in the database, but without a wingman, the BFV cannot use accepted movement techniques. The fire team leader has little or no control over where the team moves. The scenarios and the position of the EST screen determine squad locations. The fixed and co-located vehicle and dismount positions precluded realistic time and distance relationships. Physically moving 4-5 meters to mount a vehicle depicted as over 100 meters away was both unrealistic and distracting.

Table 3

Training Effectiveness for Selected ARTEP Tasks

Task Name	Effectiveness Rating	Partial Comments
Move Tactically	Ineffective	Driver auto pilot; single BFV & dismtd no flexibility, can't really move
Take Actions on Contact	Effective	But can't use movement formations
Perform Actions at Danger Area	Limited Effectiveness	No dismount IMT; heavily scripted, no flexibility
Employ Direct Fire Weapon Systems	Effective	But cannot coordinate with indirect
Employ Fire Support	Ineffective	No indirect fire capabilities
Execute Defense	Limited Effectiveness	BC can't pinpoint dismtd, can't do sector sketch
Defend against Air Attack	Limited Effectiveness	BC can't pinpoint dismtd, screen changes before sector sketch complete
Perform Overwatch/Support by Fire	Limited Effectiveness	No dismtd mvmt, BC can't tell where dismtd are, danger in shift fires, no indirect fires

Take actions on contact. Positive marks were partially qualified. For example, the raters agreed that the FIST-B could be used to perform the task Take Actions on Contact where the dismounted element reacted to and reported fire. The squad leader controls his squad, using appropriate fire and maneuver techniques. However, there were only a few actions they could actually take. They could engage targets with direct fire weapons but could not take any kind of evasive action. Since they could not be killed, there was no penalty for failure to take appropriate actions on contact or for failure to move correctly. In one scenario, for example, a SAW gunner fired at all of the dismount targets, killing most of them by himself. Soldiers in the other five lanes barely participated. This represented taking actions on contact, but clearly not to standard.

Perform actions at danger areas. Taking actions at a danger area includes posting security and use of appropriate movement techniques. The leader must perform a reconnaissance, and estimate or plan clearing methods or crossing a defile. To some extent they could take actions at a danger area. The vehicle could stop, for example, in front of the bridge. The BC could tell the dismount element to get out and secure the bridge. They could and did fire at the troops in the water, and on the other side of the bridge – but could not perform the required movement techniques to get to the bridge, could not cover each other, and could not secure the ground taken.

Employ direct fire weapon systems. The FIST-B permitted direct fire gunnery engagements. Modifications to visuals, ballistics, TOW engagement rules, etc., will increase accuracy and expand training value. Leaders must determine priority of engagements, engage/disengage criteria, assign fields of fire and coordinate with higher. Usually these areas would be covered in unit SOPs. However, without SOPs, fire control measures were non-existent. The BC could defer targets to the dismount but without knowledge of the specific scenario, he was always reactive.

Employ fire support. The FIST-B squad and crew might have offered fire support – but there was no one to be supported and no fire support plan. There were no indirect fire assets, and very often both the dismount and the turret had targets at the same time. They were not interlocking fires and supporting each other; they were firing in tandem. Communication did not occur until after the engagement. The synchronization implicit in employment of fire support was impossible.

Execute defense. The defense requires troop leading procedures and reconnaissance. Security is paramount and primary, alternate and supplementary positions are prepared and occupied. Obstacles are emplaced, range cards and sector sketches drawn, and rehearsals conducted as time permits. In FIST-B, all defense was a hasty defense. All targets were directly in front of the troops. The only times sector sketches and range cards were attempted, the scene changed and targets appeared before they were finished. Sectors of responsibility were defined, but no other work was completed. Fire distribution was not enforced. Because of the few scenarios, the squads learned, after the second iteration of each exercise, how and where to kill the targets as soon as they presented. With more scenarios, degradation of the BFV and casualties to individual soldiers, effects of mistakes and poor judgement would be more apparent.

Defend against air attack. Defense against air attack requires a plan or SOP, neither of which was in evidence. The mounted crew fired, as did the dismounts, but air defense techniques were not apparent. The AT4 engaged helicopters, but most were stationary. Generally, aerial targets were reported when seen. The crew engaged fast-moving targets, usually unsuccessfully. Some of this was due to unrealistic distances and angles of presentation. Choppers were rarely in a position that allowed them to fire on the BFV, yet incoming rounds appeared in the gunner's field of view.

Perform overwatch/support by fire. In perform overwatch/support by fire, many of the same requirements for reconnaissance, security and troop leading procedures are present. Fires must be controlled, lifted and shifted on signal. The scenarios did not permit the dismount and the BFV to assault, and the lack of indirect fires made this task very unrealistic. There was no one to support or be supported by; they just fired until the targets disappeared.

Summary. Although some aspects of some squad collective tasks could be performed while the crew was in the BFV using the FIST-B and the squad was using the EST, the device per se contributed little to performance of the ARTEP tasks. They were

using the same database but their activities were more or less independent. The crew attended to their targets and the squad to theirs.

Gunnery - Mounted

In this assessment, we trained new crews each time. To the extent that the FIST-B can be used for training new crews, this is good. However it did not permit us to make very broad statements about FIST-B gunnery. The FIST-B turret capabilities, mimicking the COFT, should have permitted the crew to improve in gunnery procedures (target acquisition and engagement). With a normal I/O critique, crews would probably have shown improvements. Although the I/O attempted to provide feedback on gunnery, time constraints meant that most of the focus ended up on the efforts of the dismount element. Gunnery performance overall was fairly poor. Often crews did not find the targets in time – or at all. There were incorrect gunnery procedures, and truncated fire commands. Without crew cuts this behavior occurred without penalty. In this respect (requirement for a good critique), the FIST-B was just like the COFT.

Additionally, the BC, unfamiliar with the scenarios, always had to listen to the platoon leader for guidance on when to tell the troops to dismount. His attention was frequently distracted from the targets before him. In some cases, the BC was so involved with the radio that the gunner did not wait for execution commands. Targets presented, the gunner engaged and destroyed them, and the BC reported. In other instances everything came to a halt. Again, SOPs would have helped. At least once while the dismounted squad leader was trying to report back, the BC requested that he not talk to him while he was trying to engage targets. This exchange highlights the problems inherent in training the dismount and mounted crews together – and the need for it.

Gunnery – Dismounted

Dismounted gunnery with the EST was of little overall value. The soldiers were not able to zero their own weapons and time was spent trying to determine aim points. They tended to treat the task like a shooting gallery, with "free for all" shooting. Since ammunition was unlimited, there were no penalties for poor fire control and no need to conserve ammunition. Targets did not take evasive action; they were suppressed only when killed. Poor habits were not automatically corrected. When an AT4 gunner rose to a kneeing position to get a better aim at approaching BMPs, he was left totally unprotected by his squad members. After an O/C critique the squad covered him for a few exercises and then forgot about it – but it did not matter because he could not be killed. One squad leader noted that the SAW gunner could "hose" the woodline and kill all the troop targets, possible in FIST-B but unlikely otherwise.

One aspect of gunnery is safety. After each scenario when the squads had remounted the vehicle, the O/C manually checked that the weapons had been returned to SAFE. Most were not. After he provided feedback, better performance was observed, but it was inconsistent. Sometimes the weapons were on safe, sometimes

not. There were no particular patterns, nor was the fault just in one lane. Since all know that weapons must be placed on safe, either they did not perceive these to be real weapons, or they did not perceive themselves to be in a real training situation in the EST.

Computer Printouts

With respect to the traditional gunnery measures, the FIST-B computer printouts reflected COFT-like data and new items to accommodate the dismount element. During the first week it was not possible from the printout to determine whether targets belonged to the crew or to the dismounts. During the second week the format was changed to show this information. Originally all target distances were reported as from the Bradley. This was changed to reflect distance from the troops on the ground or from the Bradley for the crew engagements. Additionally, documenting exposure time was of little use; the dismounts frequently found their targets exposed before they dismounted.

At the bottom of the squad performance sheets a summary of rounds fired, hits, and kills is maintained. However, it was apparent that this particular accounting was in error as frequently when we had all observed a particular lane firing and target effects from hits, the summary sheet indicated no shots fired. Eventually the counters were fixed somewhat, but little confidence was held in their accuracy. This made between week and within week comparisons nearly impossible. By-lane printouts would assist the O/C in AARs.

Soldier Questionnaires

The test soldiers completed assessment questionnaires. The intent was to have them done twice, to see if attitudes changed during the assessment. This proved to be impossible, as with the exception of the first week, personnel turnover was so great that obtaining even one answer sheet was difficult. The crews and dismounts answered the same questions although they were worded slightly differently to accommodate the difference between mounted and dismounted equipment. We assessed ease of use and realism, and attempted to elicit comment on visual target effects, cues, etc. A second section covered the perceived training value of the device.

The squads rated aspects of the FIST-B on similarity to the real world, on a scale from 1 (very similar) to 5 (not very similar). Most were said to be similar to the real world but similarity (realism) was not well defined. They also gave a rating to determine how effectively they felt they could train or rehearse tasks in FIST-B. The mean ratings from 27 soldiers are shown in Table 4. Although most tasks were rated as realistic, there were definite differences in ratings. The more realistic ones were communication and shooting. Coordination and responding to the visual graphics (dead space, range estimation) were more difficult. Training effectiveness also varied. As will be noted later, comments made by the soldiers during the interviews and during the actual assessment were not as positive as these data would imply. Although they thought they could identify assigned sectors and targets, they engaged targets without practicing fire

distribution and control, without any penalty for error. They communicated effectively with each other, but knew they were not performing to standard.

Table 4

Infantry Team Assessment Ratings

Similarity	Effectiveness	Subtask
1.37	1.33	Communicate with fire team members
1.59	1.81	Fire your weapon
1.70	1.59	Identify assigned sectors
1.71	1.35	Communicate with higher
1.74	1.78	Engage targets as a member of a fire team
1.80	1.80	Fire distribution/control fires
1.81	1.77	Engage targets as an individual
1.88	1.77	Adjust fire
2.00	1.96	Detect enemy targets
2.11	2.12	Aim your weapon
2.14	1.95	Coord fires w veh primary weapon system
2.38	2.42	Identify dead space
2.81	2.65	Estimate distance to targets

Crew/Squad Interaction and Coordination

Communication. Communications were among the highest rated aspects of the FIST-B. The squads and their BC were able to maintain communication to report enemy and friendly activities. (The artificiality of the makeshift radios was not a consideration.) Reporting procedures improved throughout the assessment as the squads began to develop SOPs and as they heeded the SME comments during the daily AARs. Sometimes, as noted earlier, BCs did not want to hear from the dismounted element while they were servicing targets. Occasionally the dismounted squad leader ignored the BC's request for information while he was engaging targets. Learning to juggle the workload is important and the FIST-B required them to do it.

Communication between the PL, I/O and BC is mandatory; it was frequently weak and hard to hear. Crews did not do communications checks as they would have in a real vehicle until prompted. During the first week, squad to vehicle communication was effectively non-existent until it was forced by the O/C. One ad hoc squad automatically briefed back the BC when told to dismount; others did it occasionally if at all. The dismounts on the ground infrequently initiated communication back to the BFV. Most often the platoon leader had to ask the BC the status of his dismounted element. Squad leader reporting improved over time, but without SME prompts, they did not maintain the performance. One squad leader started by asking for ACE (ammunition, casualty, and equipment) reports but after a few exercises did not continue.

Dismounting/remounting the vehicle. One benefit of the FIST-B is that it forces troops to practice dismounting and remounting. Several problems recurred in the attempt to look at this feature. Although there were limited attempts to provide a filled vehicle, the BFV was not combat loaded; there was much more space available than likely in a loaded vehicle. Additionally, for safety reasons, the ramp remained down.

The squads had no SOPs for dismounting or remounting. Most initial attempts were sloppy and disorganized. Over time they got smoother, but some aspects deteriorated. A squad that initially was very serious minded about dismounting, posting security, and spreading out in a tactical manner on the 10-foot run to the platform, after a number of repetitions ran only half-heartedly. Some of this was command emphasis. The squad leader lost motivation and the BC, in the turret, was unaware of what was happening. With the ramp in the down position, "ramp up" or "drop the ramp" calls to and from the driver were artificial and few paid any attention. Similarly unrealistic were calls to the BC indicating that everyone was back inside. There was no penalty for failure to dismount or remount correctly and since remounting usually signaled the end of an exercise, troops had little motivation to get back in a timely manner.

The ad hoc groups who could not actually get in the BFV did not fare much better even though their dismount and remount points were to a set location at the right rear of the vehicle. With the AC units, the 19D and 11M mixture, dismounting was inconsistent. The 11M were good at getting in and out; the 19D less so. The 19D were, however, excellent at posting security once they got out.

No two squads took security requirements in the same way. The RC squad posted one man at the rear of the BFV, just off the ramp; he waited until all others had passed by him before he ran to the line. The ad hoc week troops varied. Some were like the RC; others made dismounting a two step process where everyone got out, achieved neutral, secure positions, and then everyone ran to the firing positions. With the AC troops, the scouts maintained security until the last man was in or out; the 11Ms reported "last man" or "we're in." Some squads got better at dismounting, remounting and security, especially as they noted the observers writing and timing; but after a while when the repeated dismount and remount became unrealistic and got boring, they did not appear to try at all. A squad that did a good job one time was as likely to do a very poor job the next. One squad that had initially worked very hard on remounting, calling "go! go! go!" later showed no sense of urgency, just a very calm final report "we're up."

There was, as noted, an unrealistically short distance between the ramp and the firing line. We saw changes in times, but the performance was quite inconsistent and cannot be attributed to the FIST-B. For the ARNG troops, the time from ramp to the platform averaged 11.72 seconds. The remount time was slower, an average of 13.92 seconds. Remounting was slower because they were trying to get into a small space; occasionally a soldier dropped a magazine and picking it up, was slowed. The AC 11M/19D times averaged 12.25 and 16.27 seconds. The 19D soldiers were very thorough in security measures and kept one man out until all others were inside; this probably accounts for their relatively longer times.

Nothing suggests that FIST-B would do anything but provide an opportunity for dismounting practice. However, given the ad hoc week experiences where for safety reasons the dismount element did not actually get in and out of the vehicle, dismounting and remounting can in many respects as easily have been done without an actual vehicle.

NBC training. For the RC, after several scenarios, the O/C called "GAS! GAS!" as the troops arrived at the platform. Most exceeded the time standards for masking. Eventually masked, they initiated firing, and when the all clear was given, they simply removed their masks. The O/C provided immediate feedback. The next time they were faster, although probably not to standard, and performed proper unmasking procedures. Reporting to the turret was done only when initiated by the O/C. When a squad member had difficulty with his mask, the O/C removed him from play; the squad did not look for him, try to revive him, nor did they even appear to notice his absence. There were no buddy checks or casualty evacuation procedures. The SME mentioned this in the AAR and on the next day they performed unmasking/decontamination correctly. However, without a very close watch by a skilled trainer, bad habits recurred. The proximity of the whole squad (crew plus dismount) did not enhance performance.

Ammunition reloading. One of the most highlighted aspects of FIST-B training is practice in reloading and the decisions surrounding the decision to reload. The Bradley cannot fire any weapon while another is being reloaded. The BFV must therefore either take its chances by staying exposed, or must go to a defilade or hide position for safety. Additionally, with 25mm ammunition there are two potential reloading decision points.

With only 35-50 25mm rounds remaining, the turret low ammo light goes on. The BC must decide if he is going to go into a protected position, traverse his turret to permit the reload, and take himself out of the fight to add more linked rounds in the ready boxes. Reloading ammunition at the time of the low ammo light is time consuming, but can be done fairly rapidly by troop compartment personnel and the vehicle is not out of action very long. However, the BC can make a decision to ignore the light and fire until all rounds are expended. Once he starts, he must fire all the ammunition. The difference between these two options is in the final reloading time. If the low ammo light is ignored, then the entire feeder must be reloaded in addition to the ready boxes; this is a very time consuming process that involves dismount personnel and the gunner.

For these reasons, the opportunity to practice reloading in a simulated combat situation is desirable. Decisions on when to reload are those that the BC may be called upon to make in a firefight. The FIST-B may provide an environment for practicing these decisions. In the current configuration, however, unlimited ammunition is available; there is no penalty for failure to reload or for doing it incorrectly. Additionally, if the BC calls the squad to return to the vehicle to reload, there is no real way for them to do it. Because of FIST-B electrical wires, the turret cannot be traversed and therefore no ammunition can actually be loaded into the ready boxes or missile tubes. [One soldier said he would solve this problem by using two vehicles, one with FIST-B, the other combat loaded but not linked to the device. If the FIST-B Bradley was out of

ammunition, the second vehicle would have to reload before the first could continue the mission. Current scenarios cannot support this, however. The I/O might freeze the exercise until a real-time simulated reload occurred, but this was seen as a waste of device time.]

In the evaluation, the BC sometimes made the decision to radio to the squad to reload. One squad member entered the vehicle, pretended to open the cargo hatch cover or turret shield door, and pretended to reload. He signaled when he was finished. A typical amount of time spent was less than one minute; once the elapsed time was only 28 seconds. This is clearly unacceptable. Reloading is not a one-man job, nor can it be done in a hurry. Standards are ill defined. The Bradley Gunnery Skills Test allows 5 minutes to load the feeder and 6 minutes to load 75 rounds into a ready box – not a full box. TOW reload should take less than four minutes; the 10 seconds seen here was definitely not enough time. (Refer to Field Manual 23-1, Bradley Gunnery, 1996, for further information.) To say that FIST-B provides the opportunity to reload is, to date, incorrect. Fixing the "real-time" reload issue would enhance training benefits, by increasing realism.

Decision making. The decision making required of the BC training with his dismount element is useful only if he actually makes any decisions, and if he is rewarded or penalized for these decisions. The crews were so unfamiliar with the scenarios that the BC did not know in advance where to tell the dismounts to get out and unless the BC told them to, the dismounted element did not leave the vehicle. The platoon leader could not help until he had been through the scenarios repeatedly; only then could he cue the BC to dismount the troops. Since providing the cue to dismount was an external decision, the BC was not actually deciding anything. Sometimes the squad did not dismount in a timely manner. Since the enemy could not inflict any harm on the vehicle or its passengers, it became apparent that there was no penalty for failure to dismount. Fully scripted scenarios, with the BC and the platoon leader cognizant of decision points, would be required for the FIST-B to provide decision-making training. Even then, the BC's decisions would be made in advance, rather than on the spot.

Other Considerations

Soldier motivation and cohesion. Test soldiers were cooperative and wanted to help, but motivation and attitude varied and deteriorated. They were briefed on the purpose of the experiment and importance of their participation. They were encouraged to do their best, and to provide honest feedback. All groups started off well. The ARNG was particularly strongly motivated at first. They worked long and hard, waiting patiently when the system was down. They maintained focus from Monday through Thursday morning. By Thursday afternoon, however, they had seen the same scenarios over and over; they knew what to expect; they had little patience for recurrent system failures. The ad hoc groups were variable. The engineers maintained enthusiasm, perhaps because of the sheer novelty. The two groups of Rangers lost enthusiasm rather rapidly, as did the AC group. As soon as they had figured out the "game", they were not

interested. As was observed, the FIST-B scenario was a video game they would not choose to play.

Some instances of cohesion, or squad members being "into it" were observed. One man was very slow to dismount because he dropped a magazine and went back for it. A soldier who lost his helmet did a low crawl back to get it. A squad leader was visibly sweating from his exertions. Initially they chattered in the troop compartment and teamwork was evident. Later, the troop compartment was silent. Only rarely did the squad leader look at the map or overlay. The crews and dismount memorized the scenarios and lost tactical intensity. They regressed to "play time" or video games. When an AT4 gunner tried to fire more rounds than he was allocated, the O/C "killed" him. No one noticed he was missing and no one took over his gun. The FIST-B provided an opportunity for the squad to train together, but did nothing to reinforce it.

Training materials. There were no training materials provided, and the ARTEP T&EO worksheet was not useful. The squad had a copy of the OPORD, and graphic overlays, but most said this did not help them in navigation through the database, or in maintaining a sense of location within it, as depth perception was a severe problem. The only technical reference was a Training System Utilization Handbook (Raydon, 1996). Some "lessons learned" from the unit that had used FIST-B had been gathered; it is unknown if they had been incorporated into the scenarios or the Handbook. A full technical manual is needed.

Trainer-trainee ratio. The FIST-B requires a fully qualified highly skilled three-person team (I/O, Platoon Leader and external evaluator O/C) to train nine others, a 1:3 ratio of trainers to trainees. To reduce this burden, fully scripted scenarios must be developed to provide a read-ahead training support package for these three and possibly the BC. Without benefit of advance knowledge of the scenarios, much training value is lost. Similarly, if the driver knows where he is going, the targets will be seen and engaged; if he does not know where to go, training time is wasted.

Problems with a prototype device. System software and reliability problems degraded overall performance. The FIST-B was so unreliable that the observers could not keep up with the numbers and kinds of failures, including many database failures.

FIST-B is said to be very easy to set up and tear down. That may be the case with the turret elements that although cumbersome, are limited in complexity. A fielded device would have fewer electrical connections. The EST was more of a problem. It had power and light control demands that were difficult to accommodate. The projectors were sensitive to movement and easily lost calibration. The initial calibration and recalibration requires total darkness and technical support personnel. The weapons did not always register correctly. Since soldiers could not zero any of the weapons, all had to use burst on target techniques that caused many "first rounds" to miss.

The Power Up/Down Procedures were similar to the COFT and an experienced I/O could easily learn them. Problems surfaced when the built in test would not

complete, and options were beyond the experience of on site personnel. The I/O Station was not user friendly. The I/O had to bring a portable light in order to see the keyboard in the darkened bay and a second set of earphones so both he and the platoon leader could hear the BC. With the prototype, printing was slow; the I/O should be able to print all three screens without waiting. Our I/O was very experienced; others would require considerable training. It was not possible to watch all screens at once.

Structured Interviews

The ARI observers interviewed the test soldiers at the end of their training week. The observers had been in evidence throughout the test period and the soldiers felt comfortable with them prior to the formal interview sessions. In fact, they frequently offered unsolicited comments during the test; the daily AAR also provided opportunity for follow up. The interviewers attempted to guide the interview to cover the intended points, but accepted diversions as they occurred. The respondents were encouraged to speak freely on any subject at any time.

The ARNG personnel were interviewed in small groups, the ad hoc personnel in small groups or, in the case of the BC, individually. The AC soldiers were interviewed in a large group. Interview length varied with the test soldiers and the interviewer. The longest was the group interview with the active duty personnel who were still eager to talk after an hour and a half. Overall, there was considerable consensus. Combined comments are provided below and detailed responses are grouped by subject area.

Best features of the FIST-B. The first question was "What are the best things about the FIST-B?" The most obvious good feature of the FIST-B, and most often mentioned, was the chance for the mounted and dismounted element to train together as a full squad on a real vehicle. They liked the potential for communication and cohesion. They also said that FIST-B could provide enhanced command and control opportunities for the BFV and the dismounted element. Although their ability to move was limited, they could shoot, and they could communicate. Most praise centered on the cohesion opportunities for the squad, and the potential to integrate a new squad member, or to train a new gunner. The FIST-B crew gunnery portion was seen as useful and a supplement to the COFT but the EST was, in its present link with the BFV, mainly "shoot-em-up" target practice.

When pressed, they agreed that despite the inadequacies described earlier, parts of some collective tasks could be practiced using the FIST-B, but they said the tasks could also be practiced without the FIST-B. They said that if properly critiqued, squad NBC procedures and dismount/remount drills could be rehearsed. Fire distribution and control for both the crew and the dismount could be trained, although most admitted they had not tried to apply these principles. They could see the potential for ammunition resupply. Range cards and weapons safety could be stressed, as well as aspects of target detection and selection. They did the collective tasks, but the device neither helped nor hindered them.

Least desirable features. In its current configuration, the least desirable aspect of the FIST-B device was the scenarios – the number and variety available, and the inability of the enemy to kill FIST-B personnel. Whatever the scenario, the dismount was always in a hasty defense. Lack of indirect fire was a detractor. Freedom of movement, for the BFV and the dismount was limited, as was the ability to fight during reduced visibility. Several commented on the "shooting gallery" effect with troops just standing out in front, waiting to be killed. A drawback to the opportunity for direct fire practice was the inability to zero.

They felt that scenarios were too few, contrived, and not seamless. The time lapse between the end of one twelve to fifteen-minute scenario and the start of the next was too long, and the squads learned to expect a time lag. Their momentum and motivation slowed; their attention dropped between exercises. (They noted the "hurry up and wait" phenomenon.) They said that although some crew/squad integrating tasks could be accomplished, the fact that they could not be killed lead them to practice some bad habits. They acknowledged that the FIST-B might help teach, for example, aiming, but they knew they were not aiming, just shooting, and not acting like a squad. One vehicle, in isolation, was not practicing fire distribution and control.

Additional Soldier Comments

Target and terrain effects. Comments on and comparisons with the COFT were inevitable. Some observed that the FIST-B in the turret is "a COFT without the auxiliary sight." Several said how much better they liked the FIST-B graphics. With respect to graphic representations, some said the FIST-B targets appeared bigger than they should have been, and the RPG team at 2000 meters was too easily seen. Additionally, helicopters seemed to fly too fast. Some said a few Infantry targets looked to be out of range – but they did not ask the BC to help them estimate range, further showing the lack of "integration" between squad and crew.

Neither friendly nor enemy targets appeared realistically evasive or in any way reactive. The test soldiers stressed the need for the enemy, especially the RPG team, to shoot back although if the enemy had fired back, there was no way to maneuver to escape or hide. They said they would have preferred (simulated) grenades thrown at them and to be able to hide behind rocks and debris.

Representations of troops were better than for COFT although troops at far range moved sideways like stick men – "that's how you knew they were troops." (Several commented that they preferred the standard EST device with depictions or photographs of "real" people.) Enemy troops should have been lying down – or at least take evasive action when they were shot at. The instant insertion and removal of troop targets ("diving out of the database") was very unrealistic. Not only did they not shoot back; they just disappeared when hit. They should have moved to covered and concealed positions when engaged. Several said that it was OK to show them running, but not just standing up. ("They don't do IMT and either do you.") One commented: "And they take too long to die – they are too brave, standing when their buddies are down."

They commented on target locations, "too good" visibility, and the limited numbers and locations of buildings and trees. They suggested more weather effects, dust clouds, shadows, shimmers, and sunset. They requested night illumination, and smoke and obscuration as part of battlefield clutter. During the very brief part of the time when the desert database was up, it was very hard to acquire targets. It was always difficult to estimate distance to targets. In the European database at dusk, crews could use the thermal sight, but the driver could not see at all. The wingman was always up front, always in view, but his tracers were not visible and he never reacted.

Frequently the driver could see where dismount was shooting but the BC and gunner could not; they had no peripheral vision. When the BFV driver had control of the vehicle, the dismount team was occasionally visible on the database, even after the dismounts had physically remounted the BFV. Some times when the driver got misoriented, the next targets presented as "sticks" in the ground.

The soldiers felt that some dismount fighting positions needed to be placed near berms, that the open view was unrealistic, as was the fact that targets were always in the center of the screen and never in another sector. The European terrain had too many single trees, and no paths into and along the wood line. They wanted places for the dismount and the vehicle to go to hide or defilade, and more grass or woods. Some suggested a 180-degree screen as more realistic.

Dynamic terrain, especially for buildings, was stressed; a building shot by an AT4 should show damage. ("When you blow something up it has to blow up.") Similarly, a man shot in a window of a building disappeared when hit, but the window remained intact. Collateral damage or hand grenade effects would have increased realism, especially at the bridge. Although snow was well received, vehicle paths through the snow left no tracks and roads were too clean. Vehicles had no snow on them and they were never masked or hidden by the snow. Some conversation ensued over the need for above ground telephone poles.

Weapon effects. Numerous soldiers said that there were too many tracers in the simulation. The tracer ratio should be like the real world where the platoon leader has 1:1 tracer to ball, the squad leader 1:2, the team leader 1:4. Others said that the tracers were the wrong color and size, often too big – "like basketballs." A few commented that there was no HE splash at night and that there was little, or no dispersion with 25mm ammunition. Coax rounds appeared without tracers and the HE ammunition was ineffective against troops. During the final week, there were residual tracers on the EST screen, big round spots not associated with any shots. Another unrealistic visual effect was that missiles were "reloaded" too fast, before anyone had physically tried to execute a reload. Some suggested adding mobility and firepower kills.

Equipment issues. The AT4 had a trigger problem that made it hard to shoot and some test soldiers became discouraged. The grenade launcher had incorrect ballistics,

and it was very difficult to achieve any hits. The soldiers learned that the ammunition magazine could not be rested on the floor or the log as it triggered the sensor and made it appear to be out of ammunition. They said that the weapons looked and felt right, but that there were not enough malfunctions, especially for the SAW. They also noted the absence of weapon recoil and suggested that, for example, an impact vest might add realism, especially for the SAW gunner. The configuration of six fixed location weapons was restrictive and they were very dissatisfied with the EST contractor provided weapon zeros.

There were several problems with the EST screen. There was a small area of either space or overlap (depending on the week) between the two ten foot sections. A target on the seam could not be killed. One soldier took carefully aimed single shots and hit it repeatedly and it still would not go down. Additionally, often the two halves did not appear to be the same color. For a part of the time, the bottom half of the screen was not registering any rounds.

Driving. When the driver is not "driving", the I/O controls the speed of the "automatic driver". The speed can vary, but within a scenario, once it is set it is unchangeable – even if the I/O has selected a speed that is clearly too fast or too slow. The driver cannot judge speed; he has no speedometer. Depth perception is poor and the driver usually could not tell when he was coming up on something like water until the vehicle was almost there.

The automatic driver knows exactly where to drive or stop in the database. If the real driver is driving and does not stay on the path or go to the most preferred fighting position, the targets are not seen and the vehicle can pass right by them. The driver must pull into a preset battle position in order for the crew to be able to engage specific targets. This position fell, in one instance, counter to unit SOP that dictated another position. An experienced platoon leader (knowledgeable about the scenarios or with a fully scripted scenario) could help the driver, but an inexperienced platoon leader would not be able to anticipate the situations - he cannot guide the driver and crew on the path unless he knows it, too. A dry run with the auto driver may be helpful if time permits.

During the first week reverse gear did not appear to work. It was finally determined that the location of the gearshift lever at the end of the previous exercise impacted on where the next one started. If the driver stopped in reverse, the system thought it was in neutral, and the next time would not permit the vehicle to advance. Several drivers said they were too comfortable, not "too hot" enough. The ride in the FIST-B was too "easy." The BFV in motion lurches and is not a smooth ride, and the visual scene goes up and down with the terrain.

Audio effects. Many commented that communication within the vehicle and between the vehicle and the platoon leader or squad leader is never as good in the real world as it was in the simulation. Communications were too clear; more static and interference were needed. The radio was also too good. The turret was sometimes called overly loud, other times too quiet. Several drivers said that it was easier to count

rounds in the simulator than in the real world as there was less noise. Several also said they could not normally hear the gunner talk. Squad members said that usually if you are in the back of the BFV you can barely hear the BC as it is very noisy.

One crew said turret sounds are louder in the real world, except for the engine, which is quieter. Other crews said turret operations were not noisy enough and more gun fan and motor noise was needed. The sound level, at least to the observers, appeared to vary over the three weeks, almost as if someone were turning up and down a volume knob. Sometimes crew to squad radio traffic could be heard from the outside of the vehicle, others not. The I/O and platoon leader could not communicate off the "net" without removing their headsets, and missing the crew/dismount communications.

Several said that more battlefield noise was also needed for the dismount team, which ought to be able to hear the helicopters, the rotor and rotor wash, and, as they engage, the sounds of enemy vehicles and hostile gunfire. They thought that they needed air or smoke in their faces, that they were too comfortable for realism. They also wanted to hear the sound of the Bradley firing. They also commented on the fact that between scenarios, their own vehicle engine "stopped", bringing a silence that was a definite cue that there was to be a lengthy break before the next activity.

Communication and reporting. Communication between BC and squad leader and the squad leader and troops was unrealistic. FIST-B squad members were immediately adjacent to one another. In a real situation they would have been spread out, and the squad leader would have had to go to the fire team leaders for ACE (ammunition, casualties, equipment) reports, or radio to them, rather than just asking or leaning over. The squad leader rarely got up to go from man to man to check that each knew his sector. One said there was no pressure on the leader to provide accurate and timely reports. The shoulder to shoulder positioning of troops was unrealistic and too easy; the dismount element would be more spread out. Others questioned having the dismount in such a confined location. "Would you run in a group? Probably not."

Some individuals called out when they were reloading. One said that lack of stress made changing magazines much easier than it should have been. Some called targets for the AT4 or the SAW gunner or announced activity in their sector. One squad leader was heard to say, "Slow down, take well aimed shots." Another encouraged the SAW gunner to be systematic, with a Z-pattern. All groups provided situation reports (SITREPs) to the BC. Some gave ACE reports only when prompted. Some also helped the AT4 gunner with "target, cease fire." One AT4 gunner asked, "How far away is the Bradley? I need more ammo." The squad leader did not know, nor did the BC. "Don't shoot – it's a Bradley!" was heard when the wingman vehicle appeared.

Different groups exhibited varying skills at communication; not surprisingly the RTB squads were best. Their squad leaders briefed back the mission to the BC before they assumed the firing positions, and once set; the Squad Leader confirmed his position with the turret. Reports of enemy aviation or enemy in general ("contact right flank") appeared more SOP-driven for the RTB than for other groups. Their reports

were practiced, consistent and thorough. The differences in communication patterns were useful. They show the value of SOPs, and what can be achieved with the proper emphasis. FIST-B provided an opportunity for the BC and squad leader to communicate.

Scenarios. As noted previously, the scenarios were inadequate. There were many reasons for this, most of which have been detailed earlier. Soldiers said that the exercises stopped and started too often for realism, that freezing one exercise, starting the next after a period of time (up to two minutes) and then catching up in space to the previous scenario or situation was not a good idea. There needs to be a "link" between the scenarios for a better flow. If need be, the platoon leader could give a FRAGO in between scenarios; "morphing" was unacceptable. Jumping around within and between all the scenarios caused a lack of orientation; it was difficult to maintain knowledge of the cardinal directions. Situational awareness was only to the front and similarity between all the exercises made definition of a tactical flow of events difficult.

Several commented on the non-tactical aspects of the scenarios. For the road crossing, they felt that part of the squad would have sought cover or provided support by fire for the rest. Moving all troops (friendly or enemy) on the same route across the road at constant speed one at a time when under fire seemed unlikely. Some moving targets were almost tactical, but most stationary ones were not. They were, as noted, too brave, and if standing, could be picked off with one shot by a good rifleman. They knew to shoot the "more dangerous" prone enemy soldier first but usually shot the standing targets first, as there was no penalty for improper procedure.

They felt that the leader's plan should not be constrained by the capabilities of the system. As an example the driver should be able to drive anywhere on the database as long as he stays on the axis of advance. He should not have to be concerned with hitting the proper "spots on the ground" to trigger targets. The exercises should provide scenario driven targets rather than terrain driven targets.

A large library of scenarios is needed; otherwise they are too easy to memorize even with variable weather and visibility. (Snow was a novelty but they recognized the scenarios and target placement anyway.) Different scenarios with different sectors and different avenues of approach are required for any kind of realistic training. Scenarios could be progressive and matrixed for difficulty, but must be seamless, and with diverse response options. An advanced scenario might have a revolving screen, with targets with the ability to go inside buildings, in trenches, or behind trees.

In training support packages, BC prompts have to be carefully scripted or the training value of any integration of crew and dismount will be lost. At the very least, the O/C and the platoon leader or battle master must have a detailed working knowledge of exercise content and sequences before training starts. Details should include exercise numbers and description, the tactical play anticipated, target location, type and quantity, and the primary AAR training and teaching points. FIST-B as an integrating device highlights the need for unit SOPs and skilled trainers.

Where to use FIST-B. We also asked how they would use the FIST-B if they were the platoon master gunner or primary trainer. Several said they would not put it in the armory and would not move it around, but would find a vacant warehouse and keep it there permanently on a vehicle. They would rotate through it by company. Others said there needed to be more than one per battalion, and not located at battalion headquarters. Others doubted that company level would ever have devices. They wanted it at the armory so it would always be up, unlike the Mobile COFT, which is frequently unavailable for training. They also suggested putting the EST separately in a day room and take the squad to it to work on things that can not be done conveniently on the range. They said that if the scenarios were right, they could train night fighting tasks in the day.

With respect to portability and mobility, many thought the device, whether the full FIST-B (turret and EST) or either portion alone should not be moved. Many reported that "every time you take something apart and try to put it back together it does not work." Some suggested that the turret portion might be moved without the EST. A big drawback of the EST is the calibration, and the problems from ambient light. The EST, in any way "mishandled" may require re-calibration, bringing hours of lost training time.

Potential uses for FIST-B. All agreed that currently, the FIST-B is not ready. Overall the soldiers felt that the FIST-B could help them train the Bradley to work as a "total" team. It was seen as a simulation that can help the dismounted element of a Bradley unit improve skills in communication and coordination. The FIST-B lets soldiers determine "who and what is weak or strong" and make changes in subsequent training. They suggested a progression from Weaponeer through MACS (Multipurpose Arcade Combat Simulator) to the EST. It could be used as a building block between gunnery Table II (Bradley Crew Proficiency Course) and Table III (Bradley Squad/Section Exercise) and called the gateway to collective tasks.

FIST-B could be used for gunnery manipulation training, trigger control, and target acquisition. It can help in initiation, development, test or practice of SOPs for gunnery corrections (e.g., range v target forms), area suppression techniques. Others said it was not a gunnery tool, but could be used for rehearsal and practice for Table XII or to assist a new gunner, or provide sustainment for the weakest crew. As a full device (FIST-B plus EST) it could be used for squad or platoon drills, and to help new personnel "get familiar with move, shoot, and communicate until they are second nature," integrating a new gunner into the system other than in the COFT. A unit could train misfire procedures, command and control, and some aspects of MOUT. It is also possible to learn cause and effect if the wrong weapons are employed, and learn to communicate under stress or pressure.

They said that FIST-B could be used for integration by practicing communication between turret and ground prior to field exercises. It could be used for team work and squad tactics, movement and troop leading. It could cross train the squad and gunner, and to integrate the BC, driver and gunner with each other, and with the dismount

element. It could be used for new crew gunnery, drills and fire commands. A unit could do individual and collective tasks, integrating them with leader skills and distribution of fire. If tracers were available a leader could do fire distribution ("on my tracers") for fire control. The leader could teach fire discipline, and possibly vehicle identification.

Most of the comments on use of the FIST-B, it should be noted, focused on benefits to cohesion, communication and gunnery. The opportunity to perform or practice ARTEP collective tasks (MTC, attack, defend) was not mentioned as a FIST-B benefit; few of the soldiers ever said anything about a semblance of a tactical context. "Train together" rapidly evolved into crew gunnery (Mode I) and squad to vehicle communication. They focused on the activities; the device was rarely mentioned as the enabling vehicle.

Summary

Interpretation of the results is difficult. What do they mean? In effect, all squads became ad hoc squads. This was not entirely bad as it showed that FIST-B (turret FIST-B plus EST) could be used to train new squads or crews. But it does not provide any data on what would happen to a squad with procedures and SOPs well spelled out. Would they be helped or hampered by the FIST-B, or would there be no effect at all?

The gunnery portion of FIST-B (Mode I) may be said to do no harm. The small sample size limits an effectiveness assessment and there was never any intent in this study to evaluate Mode I. Discussing device-based training effectiveness, Boldovici and Kolasinski (1997) cautioned about assuming that no statistical difference between device and conventional training means no difference in effectiveness. Statistical insignificance does not mean that two things are equal. One presumes that the benefits from COFT and FIST-B data are comparable, but it cannot be stated for certain, and probably given the proliferation of COFTs, no true comparison could ever be made. The likelihood of FIST-B and COFT producing the same crew gunnery behavior is greater without dismounts; the BC can focus on his targets without distraction.

Asked what they liked about the FIST-B, many favorable comments focused on the graphics (better than COFT) or the fact that they got to shoot so many targets. Neither of these is a valid reason for procurement. None had seen Close Combat Tactical Trainer (CCTT) graphics (better than FIST-B or COFT) so they could not comment on the relative goodness. Whether the FIST-B enhanced graphics would be more helpful than COFT is open to debate. Pleban, Brown and Martin (1997) reported development of computer-based training materials, where test soldiers found the modules aesthetically pleasing. They commented that in the final analysis, it must be shown that the material in question can be efficiently taught using the instructional approach provided. Just because it is pretty does not mean that it is good.

Another undeniable advantage to the FIST-B was the use of a real BFV, "your own vehicle." However, it is not your own vehicle, but more than likely one that is set up at the armory on a more or less permanent basis. In all likelihood it is a dead lined

vehicle, one that cannot be used for other purposes. If the device (turret strap on) is moved to another location it can be placed on a different vehicle; the movement and emplacement of the EST screen is more of a chore.

The FIST-B provided opportunity for cohesion building in the squad. This would help new personnel become integrated into the squad and learn squad SOPs. However, when attitudes declined, deterioration spread rapidly inside the rest of the squad. The BC stayed in the turret; the squad leader was on the ground with the troops. If there had been a switch in personnel so that the ranking person was on the ground, a difference might have been seen. Within-squad cohesion from an already intact squad would probably not have increased with FIST-B.

Training the BFV crew and dismount together may help with the we-they attitude sometimes found in BFV squads. However, since there was really very little interaction between the crew and the dismount element, this benefit is still tangential. The crew did what it needed to do, and the squad did its part, reporting back as needed but they really did not work together. This may be as much due to the scenarios, and the inability of the enemy to shoot back, as to anything else. As for the driver, his participation was minimal. When he actually drove, unless he knew the scenario he was lost. By the time he knew the scenario, everyone else did too. Some drivers were able to count rounds and to assist in spotting targets; others were either unaware of this responsibility, or unable to do it.

Many of the system constraints were due to the prototype nature of the device. This accounted for software and I/O station problems. The scenarios were too limited and not sufficiently seamless or complex to maintain user interest. Personnel problems have been alluded to before. We did not get the squads requested; those we got were in many ways wrong. The ARNG group did a good job, but having the private, 10 months in the Army, as the SAW gunner was clearly not a wise decision. Similarly, the mixture of 11M and 19D was unrealistic and not at all what we had requested. They worked well together once they got started, but the data may not be very generalizable.

The platoon leader position was filled by one of the SMEs. He was highly motivated, well trained, and somewhat familiar with the scenarios. Another individual, less motivated, would have more difficulty maintaining interest, and might not be so effective as a trainer. Similarly, a well-trained O/C is mandatory. The O/C had to watch the training very carefully and decide which items to focus on in his AAR critiques. A trainer from the unit might have had a plan for specific tasks to observe, but this O/C found no limit to tasks to evaluate. The I/O, as previously noted, was an experienced gunner and I/O. His lack of familiarity with the system hampered his ability to operate the system and delayed training on a number of occasions. This will be a consideration in unit training as well. Pre- and post training briefing time was limited or non-existent.

As stressed before, all three trainers must be very skilled. Otherwise training time is wasted and bad habits will reoccur. This requirement is not unique to working with the FIST-B. The question remains as to whether the FIST-B (turret appended plus

EST) provides sufficient value added to BFV training to make it worth while. Each trainer has a large workload; they must also work together, not only during the training, but also in preparation and during AARs. The trainers must coordinate their activities for maximum benefit. They must all be intimately familiar with the FIST-B scenarios. What is the likelihood of a unit being able (or willing) to devote three of its best trainers to the FIST-B? Finally, do the benefits provided by the fact that the crew and dismounts are training in the same location outweigh the disadvantages?

Other Issues

Bradley Platoon Training Requirements

The FIST-B provides a training opportunity for up to nine persons simultaneously, three in the BFV and six on the ground as the squad. The six and three configuration is atypical. And, as the test soldiers were quick to note, Bradleys do not fight alone. A Bradley platoon is comprised of four vehicles and a varying number of dismount personnel. The current configuration suggests that each two vehicle section has approximately nine 11Ms (the dismount squad comprised of two fire teams and a squad leader) plus up to a five man machinegun squad (see FM 7-7J, 1993).

For preliminary gunnery, Bradley crews and their dismount elements can be trained separately. After individual weapon qualification, emphasis shifts to crew and squad preparation for the Bradley Squad/Section Exercise (BSSE) (Bradley Table III) which integrates the dismount squad and vehicle section. The BSSE comprises crew drills (mount/dismount), battle drills (react to contact-mounted), squad and sector sketches, etc. This prepares them for Table IV, the Bradley Platoon Proficiency Exercise which integrates mounted and dismounted elements in such collective tasks as overwatch/support by fire, assault mounted, execute the defense, prepare a platoon sector sketch. Tables V through VII are practice for Table VIII, live fire gunnery, which is crew qualification for the BC, gunner and driver. Bradley Tables XI and XII provide the platoon level collective link to the ARTEP, Mission Training Plan, and are evaluated in accordance with the ARTEP 7-7J T&EO. (See FM 23-1, 1996 for Bradley gunnery.)

Dismounted Infantry Training Concerns

The active component, with the availability of the COFT or SIMNET (soon CCTT) has acknowledged a need to provide further training for dismounted Infantry soldiers. It has elected to gain this added training through purchase of an improved EST. The device will provide marksmanship, shoot/don't shoot decision training and unit collective squad level training scenarios for Infantry and other elements. The prototype device should be available to the Infantry School in mid-1998. (See STRICOM, 1997a and 1997b.)

The EST will be a multipurpose multilane small arms, crew served and individual anti-tank training simulation device which supports individual and crew served weapons training indoors. It will simulate institutional and unit weapon training events from initial

entry training to live fire qualification; combat effectiveness through quick fire, decision training; and squad collective training for defend and ambush missions. It will provide fire team and squad leader training in command, control, and distribution of fires. The device will have five to ten lanes. Targets will be responsive (hit, incapacitation, suppression, kill) and will seek realistic cover and concealment under appropriate battlefield conditions, terrain, visibility and weather effects. A playback mode will have individual soldier shot groups, and squad, team and individual data.

ARNG Bradley Training Requirements and Devices

National Guard units are to be trained to the same standards as Active Component units, and have the same individual and collective training requirements. Individual weapons and crew qualification are conducted at annual training and during special "pile-on" weekend drills. As noted earlier, training time is restricted, and must be used efficiently. Training devices are used when and wherever practicable to maximize the benefits of the limited time.

The ARNG Regulation 350-2 (March, 1995) states that the Bradley gunner and commander will train target acquisition, reticle aim and systems management in the COFT as required to sustain gunnery proficiency. Maneuver training and collective tasks will be practiced using SIMNET or the Mobile CCTT. In addition to COFTs, most Guard units have access to a standalone EST and the VIGS (Videodisc Integrated Gunnery Simulator). All units have access to MILES (Multiple Integrated Laser Engagement System).

A new device, the Precision Gunnery System (PGS) is initially being fielded to two brigades of the National Guard (Campbell, 1997). PGS is a laser firing system designed to improve platoon and individual gunnery skills, platoon maneuver tasks and battle drills. It is being tested at Fort Lewis, WA, and being used together with JANUS and platoon STX lanes. PGS will provide home station gunnery (Mode I Panel Gunnery) and maneuver simulation (Mode II Combat Gunnery) and can be used for force on force training. One author referred to PGS as the "future of home station training in the U.S. Army" (Campbell, 1997).

Some Guard units, however, may still perceive a need for additional methods for achieving readiness. This need was the genesis for the development of the A-FIST and the Mode I portion of the FIST-B. The FIST-B device was designed for the ARNG to address the problem of too little training time, and the distances involved in getting soldiers from their homes and armories to the locations of the other devices.

Perceived Redundancies

ARNG problems with training time (and throughput) are long acknowledged. There is, however, an increasingly voiced (albeit potentially naïve) thought that in the Total Army, One Army philosophy, Active and Reserve Components should receive the same training to achieve the same standards. It is stated that the Guard will take

longer, but they can attain the standards – if they use the same training strategies and devices. This philosophy may be unrealistic. Devices are not always available when needed, and there are problems inherent in trying to train many crews and squads in limited numbers of weekends and annual training.

COFT is supposed to be available for precision gunnery training and sustainment, and SIMNET for command and control training. The CCTT and PGS will provide training in similar, if not sometimes identical, skills. When COFT is upgraded for the M2A3 Bradley and when the EST is updated, there will be many devices to train the move, shoot, and communicate skills required of the infantryman. In a downsized military with concomitant reduction in funding for devices, for ammunition, and for training as a whole, questions surface about cost and tradeoffs. Potential and even perceived device redundancy becomes an important issue.

There is a problem as to what extent the full FIST-B device (FIST-B plus EST) is needed. Although the FIST-B (in Mode I only) can replicate and then potentially replace or supplement the COFT for the ARNG, for the fully integrated crew and squad (Mode II), the benefits are less apparent. Full squad training integration is needed, but must be done with a carefully thought out plan. Including a device where none is needed is a waste of resources. Many dismounted infantry tasks can be trained without the vehicle.

FIST-B Device Assessment Summary

The FIST-B Device, in prototype form, was tested over a period of three weeks at Fort Benning, GA. Data sources included printouts from the FIST-B system (rounds, hits, and kills); I/O (crew gunnery evaluation); USAIS trainers (external evaluation of the ARTEP tasks); ARI (observations, questionnaires on realism, perceptions of device strengths and shortfalls); and results of test soldier structured interviews. Additionally ARI discussed current and future devices with the Montana unit, and with USAIS personnel responsible for Bradley training devices. The test soldiers were initially very enthusiastic. Some gunnery and crew/squad coordination skills improved over time, with AARs. However, the limited number of scenarios available for training impacted on soldier attitude as the training period progressed and they learned to anticipate target locations.

Based on the limited user assessment, the FIST-B requires upgrades to software, training materials and scenario development, regardless of decisions on procurement. Costs of the FIST-B are said to be relatively low, but reliability and maintainability issues and the need for contractor logistical support have surfaced and are not yet addressed. The FIST-B requires a light controlled room with power, a Bradley, and, in Mode II, at least three well-trained cadre. There was consensus that the strap on FIST-B turret appended portion of the device (Mode I) could be used for teaching crew gunnery techniques, and for integrating new personnel into a crew or squad. The value of the EST portion linking the crew to the dismount element for integrated collective training (Mode II) was difficult to determine.

Conclusions/Recommendations

1. In its present configuration, the turret-appended FIST-B device (Mode I) provides crew gunnery training, and to the extent that it mimics the COFT, FIST-B Mode I could probably supplement or complement the COFT if funding permits and if additional precision gunnery trainers are needed.

2. The value of adding the EST to the FIST-B for squad collective task training (Mode II) is limited at this time. Inadequacies of the existing EST and the available scenarios suggest that the improvements provided by the new EST will make any Mode II training significantly more satisfactory at a later date. When the next version of the EST becomes available, linking the FIST-B and EST can be pursued if it is still deemed necessary.

3. A fielded FIST-B system (Mode I and Mode II) would require detailed training support packages and multiple scripted scenarios. For Mode II, in addition to the I/O, the unit needs a very competent and well-trained squad leader or external evaluator, plus a notional Platoon Leader or battle master who knows the scripted scenarios. Mode II requires a high trainer to trainee ratio.

4. A reasonable course of action would suggest FIST-B turret only device procurement by National Guard units if deemed necessary to enhance readiness and gunnery skills. Guard personnel, with a very high interest in the next EST, might assist USAIS personnel in scenario development to ensure their special needs are addressed.

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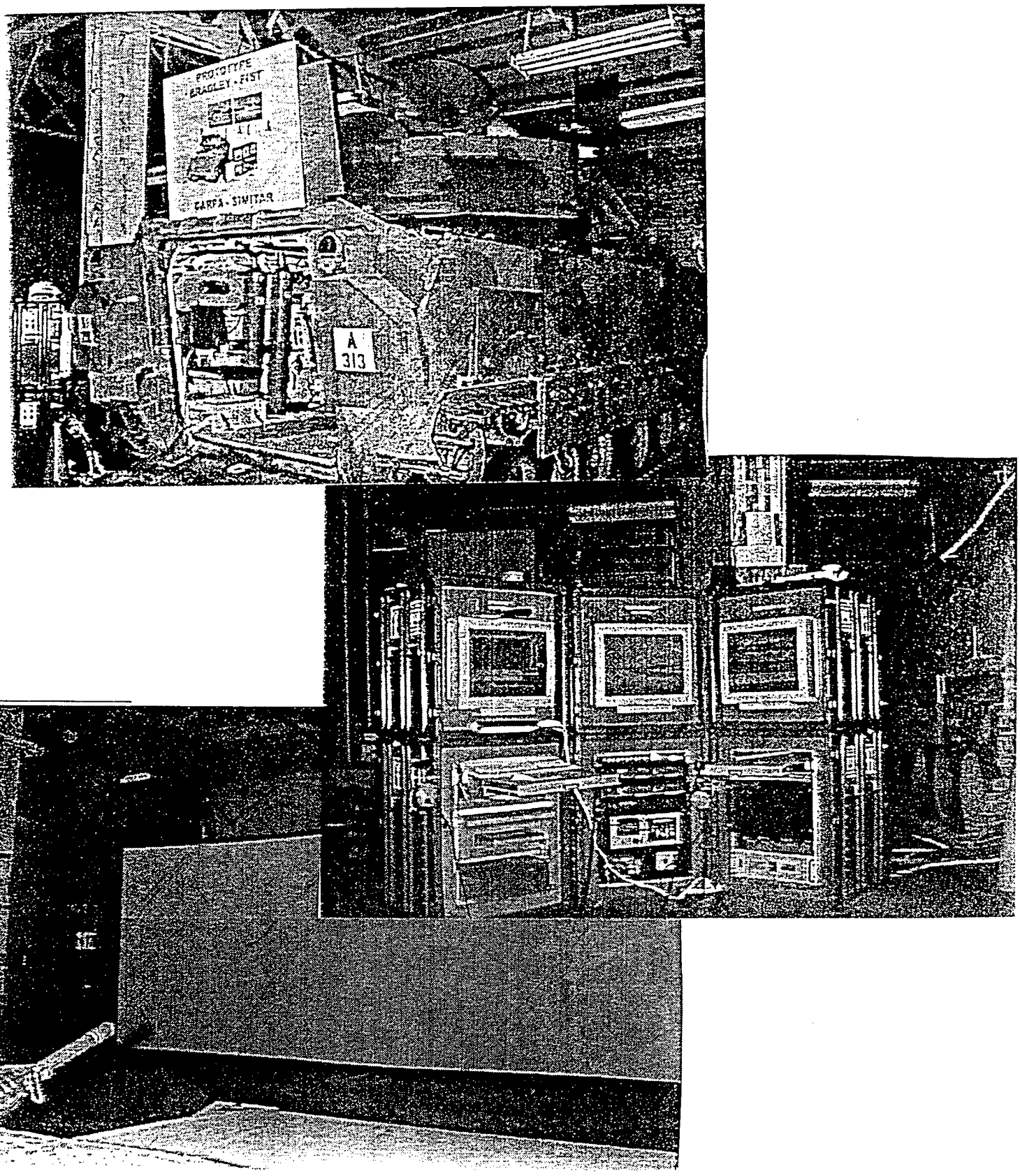
LIST OF ACRONYMS

AAR	After Action Review
AC	Active Component
ACE	Ammunition Casualty Equipment
A-FIST	Abrams Full Crew Interactive Simulation Trainer
ARI	Army Research Institute
ARNG	Army National Guard
ARTEP	Army Training and Evaluation Plan
BC	Bradley Commander
BFV	Bradley Fighting Vehicle
BSSE	Bradley Squad/Section Exercise
CCTT	Close Combat Tactical Trainer
COFT	Conduct of Fire Trainer
CVC	Combat Vehicle Crewman
DARPA	Defense Advanced Research Projects Agency
EST	Engagement Skills Trainer
FIST-B	Full Crew Interactive Simulation trainer - Bradley
FM	Field Manual
FRAGO	Fragmentary Order
GUARDFIST	Guard Unit Armory Device Full crew Interactive Simulation Trainer
I/O	Instructor/Operator
MACS	Multipurpose Arcade Combat Simulator
MILES	Multiple Integrated Laser Engagement System
MOUT	Military Operations on Urban Terrain
MOS	Military Occupational Specialty
MTC	Movement to Contact
O/C	Observer/Controller
OPORD	Operations Order
PENCIL	Pen-based Electronics Network for Command Information Linking System
PGS	Precision Gunnery System
RC	Reserve Component
RTB	Ranger Training Brigade
SAW	Squad Automatic Weapon
SIMBART	Simulation Based Mounted Brigade Training Program
SIMITAR	Simulation in Training for Advanced Readiness
SIMNET	Simulation Networking
SIMUTA	Simulation Based Multi-echelon Training Program
SITREP	Situation Report
SME	Subject Matter Expert
SOP	Standing Operating Procedures
STX	Situational Training Exercise
T&EO	Training and Evaluation Outline
USAIS	U.S. Army Infantry School
VIGS	Video Disc Integrated Gunnery Simulator

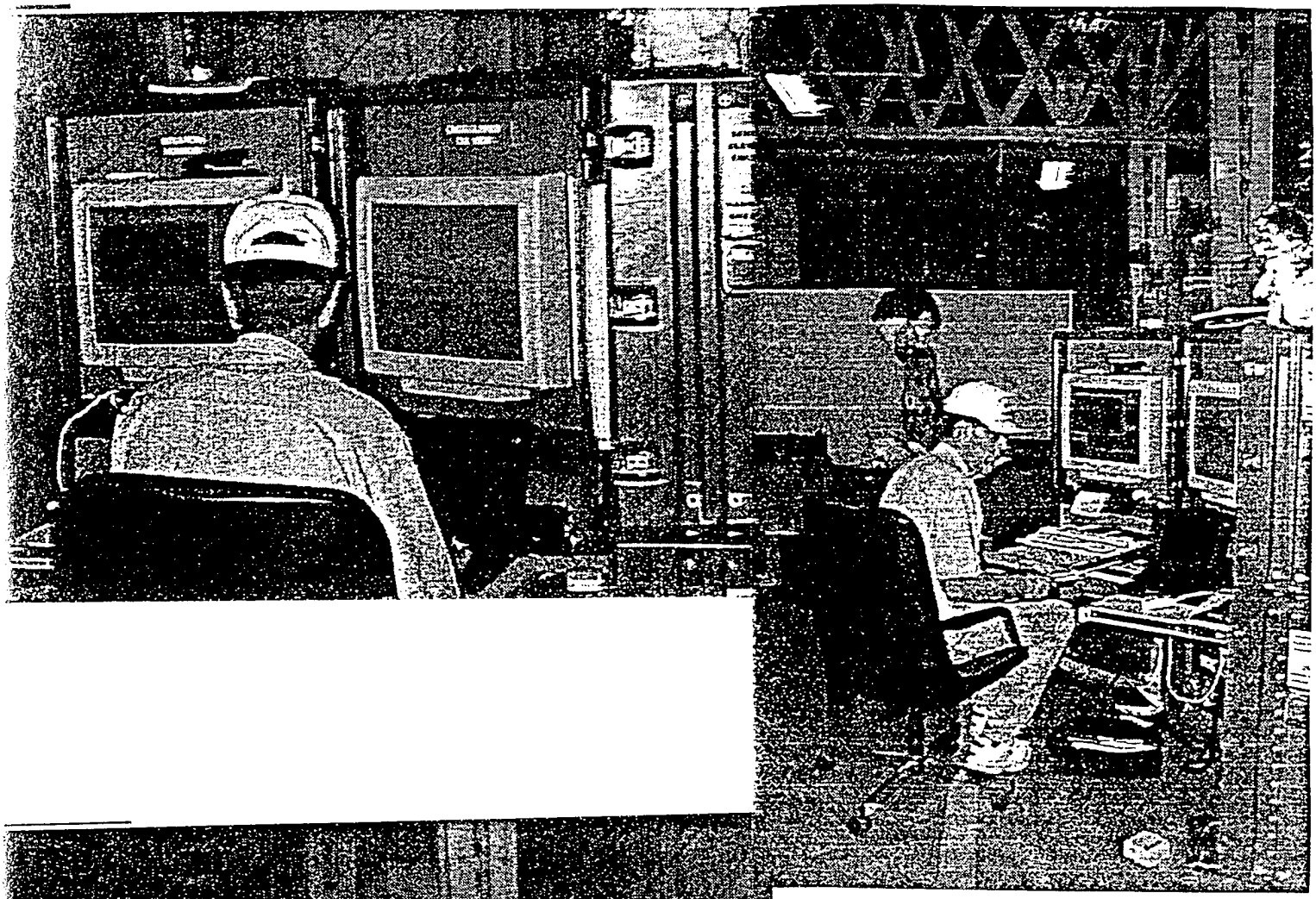
APPENDIX A

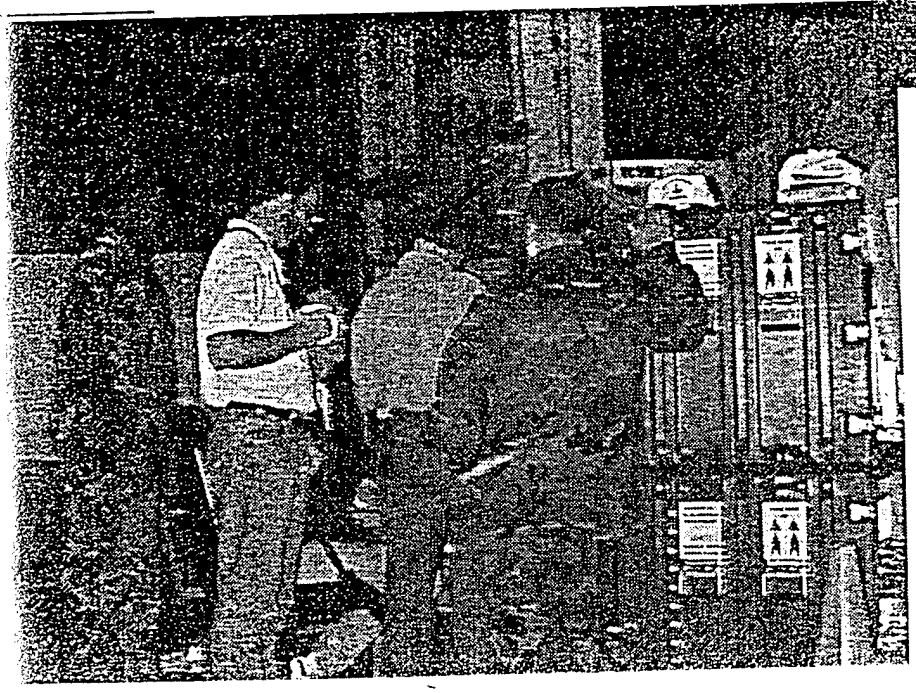
PHOTOGRAPHS

Bradley, FIST-B Instructor/Operator Station
and Engagement Skills Trainer Screen

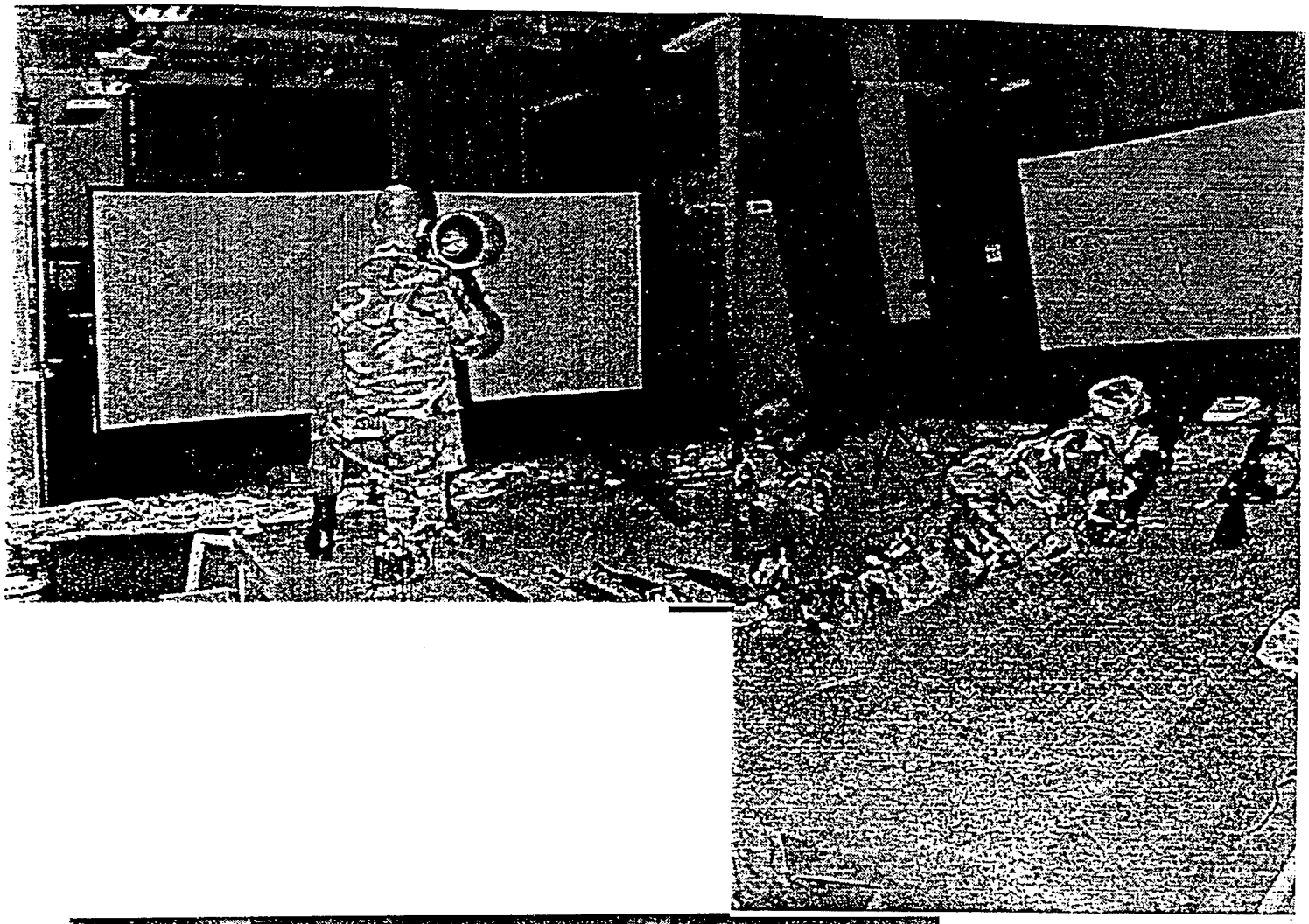


Instructor/Operator at Instructor/Operator Station;
Cadre, Researchers and Technical Support Personnel at Instructor/Operator Station

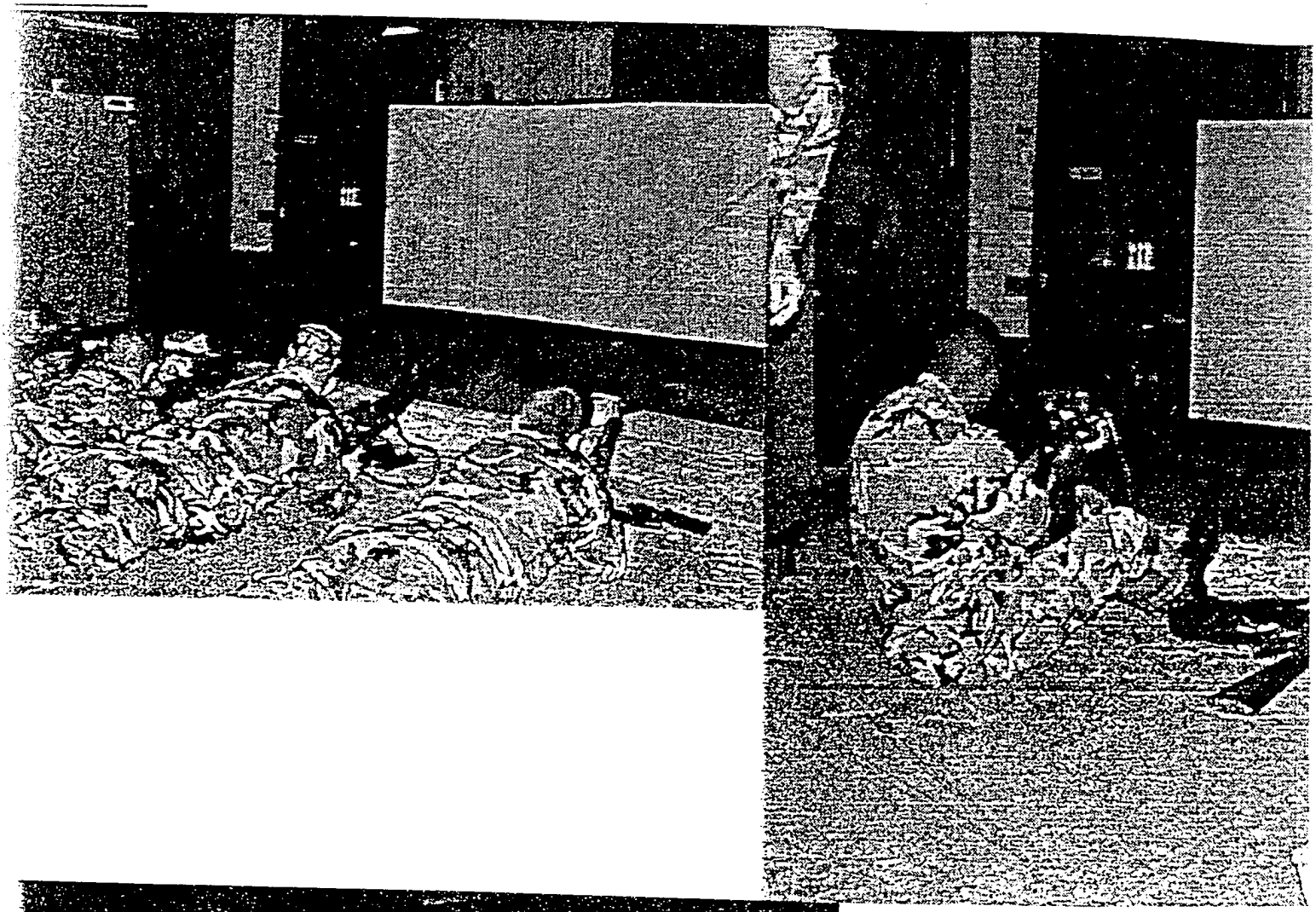


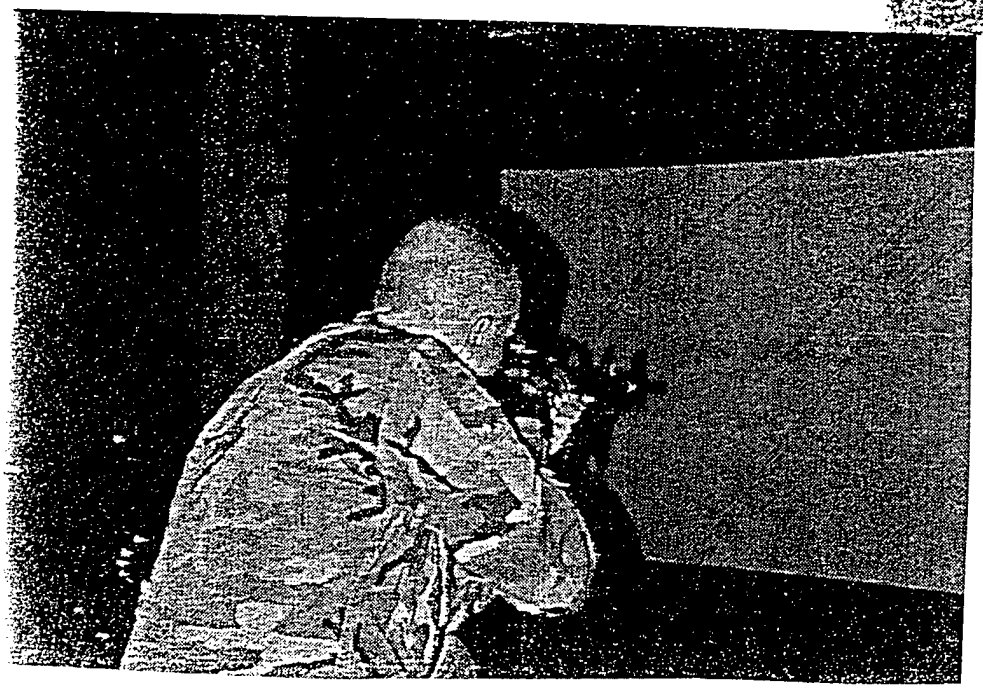


Soldiers Using Engagement Skills Trainer



Soldiers Using Engagement Skills Trainer





Appendix B

Experience Survey

FIST- B - Experience Survey

Please fill in the blanks, check (✓) or circle as necessary for each part of each question.

1. **PERSONAL INFORMATION:**

Id # (**Last four digits of SSN**) _____
Age: _____
Education: ____ High School diploma or GED
____ Some College
____ College Degree ___ Associates ___ Bachelors
____ Advanced Coursework beyond BS/BA
____ Advanced Degree ___ Masters ___ PhD

2. **MILITARY EXPERIENCE:**

Unit: _____ Rank: ____ MOS/CMF:_____
Component: _____ AC _____ RC

Time in Service: ___ Years ___ Months

Date of most recent APFT: _____ Score: _____

Current Duty Position _____ How long in this position? _____

Please list other duty positions you have held before this one.

Have you ever served as a Fire Team Leader? ___ Yes ___ No

3. **ARMY & PROFESSIONAL DEVELOPMENT TRAINING:** (Mark all that apply)

___ 11M Bradley Basic Transition Course (BBTC)
___ 11M BFV Leaders Course (BLC)
___ 11M BFV Master Gunner Course

___ Primary Leadership Development Course (PLDC)
___ Basic Noncommissioned Officer Course (BNCOC)
___ Advanced Noncommissioned Officer Course (ANCOC)
___ Battle Staff Noncommissioned Officers Course
___ Battle Skills Course (RC)
___ Officer Basic Course

___ Ranger ___ Airborne School ___ Pathfinder School
___ Air Assault School ___ Sniper School ___ Combat Life Saver Course
___ I/O Course ___ Other (please specify)

4. **GUNNERY/MARKSMANSHIP:**

Date you last took and passed the BGST (month & year) _____
Bradley Table VIII Score at last qualification (please specify) _____ Not Applicable ___
Have you ever done a Table XII? Yes No
Date of your most recent squad live fire (month & year) _____
Date of your most recent weapon qualification (month & year) _____

When you last qualified with your M16 were you:
___ Marksman ___ Sharpshooter ___ Expert ___ Not Applicable

5. **COMBAT TRAINING CENTERS:** (Number of rotations you have participated in and dates)

Joint Readiness Training Center (JRTC) ___ Number of Rotations
_____ date (month & year) of most recent JRTC Rotation

National Training Center (NTC) ___ Number of Rotations
_____ date (month & year) of most recent NTC Rotation

Combat Maneuver Training Center (CMTC) ___ Number of Rotations
_____ date (month & year) of most recent CMTC Rotation

6. **COMBAT EXPERIENCE:** Have you ever been deployed to a combat zone? ___ Yes ___ No
If yes, where? _____

7. **TRAINING DEVICES:** (Indicate your experience with these devices, using the scale below.)

1 = very much experience
2 = much experience
3 = some experience
4 = a little experience
5 = none

___ COFT (Conduct of Fire Trainer)
___ SIMNET (Simulation Networking)
___ CCTT (Close Combat Tactical Trainer)
___ PGS (Precision Gunnery System)
___ EST (Engagement Skills Trainer)
___ Weaponeer
___ FATS (Fire Arms Training System)
___ MACS (Multipurpose Arcade Combat Simulator)

8. **COMPUTERS:**

Do you own a personal computer? ___ Yes ___ No
If yes, how do you use it? ___ Games ___ School ___ Letters ___ Other (specify)

Do you use a personal computer as part of your military duties? ___ Yes ___ No

Rate your computer skills
___ Above average ___ Average ___ Below Average

9. **GAMES/VIRTUAL REALITY:**

How often do you play hand-held video games (Sega-Genesis, etc.?)

___ Daily ___ Several times a week ___ Once a week ___ Rarely ___ Never

How often do you play arcade-type video games?

___ Daily ___ Several times a week ___ Once a week ___ Rarely ___ Never

Appendix C

Infantry Team Assessment/BFV Crew Team Assessment

Infantry Team Assessment

Duty Position _____

1. Please rate the following tasks on how similar you performed them to the real world. Use a five-point scale with **1 = Yes, very similar and 5 = No, very dissimilar.** If the task was not or could not be performed, write N/A in the rating column. Use the comment column for any comments you may have.

Task	Rating	Comment
Communicate with fire team members		
Communicate with higher		
Aim your weapon		
Fire your weapon		
Engage targets as an individual		
Engage targets as member of a fire team		
Detect enemy targets		
Identify dead space		
Identify assigned sectors		
Fire distribution/control fires		
Adjust fire		
Coordinate fires with vehicle's primary weapon system		
Estimate distance to targets		

2. Use the following scale to rate the same tasks on how effectively you could train or rehearse these tasks using the FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Communicate with fire team members		
Communicate with squad leader		
Aim your weapon		
Fire your weapon		
Engage targets as an individual		
Engage targets as member of a fire team		
Detect enemy targets		
Identify dead space		
Identify assigned sectors		
Fire distribution/control fires		
Adjust fire		
Coordinate fires with vehicle's primary weapon system		

Estimate distance to targets		

3. Are the following weapon effects realistic? Answer yes or no in the realism column. If you answer no, can the weapon effects depicted by the FIST-B be a training distracter? Answer yes or no in the distracter column.

Weapon Effects	Realism (yes/no)	Distracter (yes/no)
Effects on targets		
Maximum effective range		
Visual effects		
Target behavior/realism		
Number of rounds to kill/suppress target		

Comments _____

4. How difficult was it to perform tasks in the FIST-B?

_____ easier than real world

_____ more difficult than real world

_____ about the same as real world

Comments _____

5. Could you engage targets as quickly as in the real world?

_____ quicker than real world

_____ slower than real world

_____ about the same as real world

6. How difficult was it to engage targets with your weapon?

_____ easier than real world

_____ more difficult than real world

_____ about the same as real world

7. In your opinion, could the FIST-B improve your combat marksmanship?

____yes ____no explain _____

8. During your training, you have had the opportunity to perform and/or observe members of your element perform the following tasks. Using the scale below, rate how effectively you can train the following tasks and subtasks in FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Employ direct fire weapon systems.		
Squad leader/Team leader organizes the squad into elements appropriate to the specific mission.		
Squad leader/TL designates priorities of engagement.		
Squad leader/TL designates specific element engagement priorities.		
Control measures are established.		
Engagement and disengagement criteria are established.		
Team operates under specific weapons control status (e.g., green/red).		
Fire commands are based on fire control measures (e.g., TRP, engagement lines).		
Direct and indirect fires are coordinated with moving elements.		
Team leader reports situation to the company commander.		
Take actions on contact.		
Lead element reacts to enemy fire and reports activity.		
Squad leader/TL controls his elements.		
Perform actions at danger area.		
Squad leader directs the squad to take action on encountering a defile/danger area.		
Area is reconnoitered and an estimate is made based on information received.		
Near-side security provides the security.		
Far-side team reconnoiters the far side.		
Squad crosses the defile/danger area.		
Employ fire support.		
Direct fires and indirect fires are synchronized to achieve desired outcome.		
Lift or shift fire on signal or when the assault begins.		

8. (Continued) Using the scale below, rate how effectively you can train the following tasks and subtasks in FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Execute defense.		
BC moves the section on covered and concealed routes IAW T&EO 4-3/4-4134, Move Tactically.		
The section occupies the position.		
The team leaders prepare sector sketches/gunners prepare range cards and submit a copy to the BC.		
The BC prepares a section sector sketch and sends a copy to the platoon leader.		
Establishes communications with the higher (digitally if applicable).		
Briefs the fire distribution plan.		
The section initiates contact or takes actions against the enemy.		
The BC/TL determines if the section can destroy the enemy from its assigned positions.		
The BC/TL directs actions as the enemy closes in.		
The section continues to defend the defensive position until the enemy is repelled or is ordered to disengage.		
Defend against air attack.		
The section takes action against hostile aircraft firing on the unit.		
On order, section members fire at enemy aircraft, using directed engagement technique as specified by the platoon leader or OPORD IAW T&EO 7-3-4201, Employ Direct-Fire Weapons Systems.		
The BC/TL reports enemy aircraft (type, location, course) to the company (digitally, if applicable).		
Perform overwatch support by fire.		
The support element overwatches the assault element's movement.		
The dismounts and or BFVs suppress the objective with direct or indirect fire.		
The BC/team leaders control fires onto the objective using tracer, voice commands, whistle, and visual signals IAW T&EO 7-3-4201, Employ Direct-Fire Weapons Systems.		
The section lifts or shifts fire on signal or when the assault begins (based on the SOP or OPORD).		
The BC orders the support element to cease fire. after the assault element is on the objective or when all enemy are destroyed or withdrawn from the engagement area (digitally, if applicable).		

BFV Crew Team Assessment

Duty Position _____

1. Please rate the following tasks on how similar you performed them to the real world. Use a five-point scale with **1 = Yes, very similar through 5 = No, very dissimilar.** If the task was not or could not be performed, write N/A in the rating column. Use the comment column for any comments you may have.

Task	Rating	Comment
Communicate with crew members		
Communicate with higher		
Aquire targets		
Service targets		
Identify dead space		
Identify assigned sectors		
Fire distribution/control fires		
Adjust fire		
Coordinate fires with Infantry team		
Estimate distance to targets		

2. Use the following scale to rate the same tasks on how effectively you could train or rehearse these tasks using the FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Communicate with crew members		
Communicate with higher		
Aquire targets		
Service targets		
Identify dead space		
Identify assigned sectors		
Fire distribution/control fires		
Adjust fire		
Coordinate fires with Infantry team		
Estimate distance to targets		

3. Could you engage targets as quickly as in the real world?

_____ quicker than real world

_____ slower than real world

_____ about the same as real world

4. How difficult was it to engage targets?

_____ easier than real world

_____ more difficult than real world

_____ about the same as real world

5. Are the following weapon effects realistic? Answer yes or no in the realism column. If you answer no, can the weapon effects depicted by the FIST-B be a training distracter? Answer yes or no in the distracter column.

Weapon Effects	Realism (yes/no)	Distracter (yes/no)
Effects on targets		
Maximum effective range		
Visual effects		
Target behavior/realism		
Number of rounds to kill/suppress target		

6. During your training, you have had the opportunity to perform and/or observe members of your element perform the following tasks. Using the scale below, rate how effectively you can train the following tasks and subtasks in FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Move Tactically		
The BC makes a map reconnaissance and chooses a route for movement that (digitally if applicable)—		
The BC executes movement technique to be used based on METT-T (for example, traveling–column, wedge, vee, or bounding overwatch by section).		
The vehicle commanders, and team leaders control the section's movement.		
Employ Fire Suppport		
Synchronize direct fires with indirect fire to achieve desired outcome.		
Adjust priorities of fire as battle progresses.		
Execute Defense		
BC moves the section on covered and concealed routes IAW T&EO 4-3/4-4134, Move Tactically.		
The section occupies the position.		
The team leaders prepare sector sketches/gunners prepare range cards and submit a copy to the BC.		
The BC prepares a section sector sketch and sends a copy to the platoon leader.		
Establishes communications with the higher (digitally if applicable).		
Briefs the fire distribution plan.		
The section initiates contact or takes actions against the enemy.		
The BC/TL determines if the section can destroy the enemy from its assigned positions.		
The BC/TL directs actions as the enemy closes in.		

The section continues to defend the defensive position until the enemy is repelled or is ordered to disengage.		

6. (Continued) Using the scale below, rate how effectively you can train the following tasks and subtasks in FIST-B.

1 = Very effective 2 = Generally effective 3 = Somewhat effective
4 = Generally ineffective 5 = Very ineffective N/A = Did not or could not perform

Task	Rating	Comment
Defend against air attack.		
The section takes action against hostile aircraft firing on the unit.		
On order, section members fire at enemy aircraft, using directed engagement technique as specified by the platoon leader or OPORD IAW T&EO 7-3-4201, Employ Direct-Fire Weapons Systems.		
The BC/TL reports enemy aircraft (type, location, course) to the company (digitally, if applicable).		
Employ Direct-Fire Weapons Systems		
Engage enemy targets.		
Fire control measures are followed.		
Direct and indirect fires coordinated with moving elements.		
Perform overwatch support by fire.		
The support element overwatches the assault element's movement.		
The dismounts and or BFVs suppress the objective with direct or indirect fire.		
The BC/team leaders control fires onto the objective using tracer, voice commands, whistle, and visual signals IAW T&EO 7-3-4201, Employ Direct-Fire Weapons Systems.		
The section lifts or shifts fire on signal or when the assault begins (based on the SOP or OPORD).		
The BC orders the support element to cease fire. after the assault element is on the objective or when all enemy are destroyed or withdrawn from the engagement area (digitally, if applicable).		
Take actions on contact.		
Lead element reacts to enemy fire and reports activity.		
BC/TL controls his elements.		
Perform actions at danger area.		
Squad leader directs the squad to take action on encountering a defile/danger area.		
Area is reconnoitered and an estimate is made based on information received.		
Near-side security provides the security.		
Far-side team reconnoiters the far side.		
Squad crosses the defile/danger area.		

Appendix D

Final Summary Rating for FIST-B: Structured Interview

Final Summary Rating for FIST-B
Structured Interview

Date: Time :

Name(s) :
FIST-B duty position(s):

1. What were the best features of the FIST-B?

2. What were the least desirable features of the FIST-B?

3. How well could you move, shoot and communicate?

   Does the FIST-B improve combat marksmanship? How?

4. Are there any individual or collective tasks you could train on with the FIST-B device that you could not have not trained on before?

5. What were the most realistic aspects of the FIST-B? And what were the least realistic aspects of the FIST-B?

6. What needs to be changed in the European environment terrain data base? In the desert environment ? In the snow?

7. If you were the brigade master gunner and assisting the commander in planning his training, would you want to use the FIST-B for training in your unit?

   If so, how?

   Would you leave it set up or make it portable?

   How would the FIST-B fit in with the training devices you already have in the unit?

   Do you know of any other training devices that train similar tasks? What are they?

8. What are the most important things that the FIST-B helps you train? Why?

9. What needs to be different in the FIST-B? If you were king of the world with all the money, what would you do to make it better?

Others?

Realism of
weapon simulations, ballistics, wpn alignment, controls, recoil, sounds, weight, feel, tgt acquisition, tracers, overall target acquisition

Rate visual systems - brightness, contrast, distance perception, FOV, image clarity, friendly/threat discrimination, scene clarity, resolution, depth

Rate representation of specific objects - tank, bmp, friendly, hind-d, troops, truck, explosions, roads, bridges, terrain, water, overall

Appendix E

Sample Computer Printout

M2A2/M3A2 Situation Monitor

Range Select	1200	Rnds	Rdy/Stow	Control:	GUNR		Exercise:	498312
Range Actual	0	AP	230 300	Az Mode:	PWR	Tube 1 LOAD	Vehicle :	2/21 B23
Lead	0.0	HE	29 300	El Mode:	PWR	Tube 2 LOAD	Position:	
Crosswind	10.0	TOW	2 5	TOW Mode:	PWR	Travel	Date:	9/25/97
Tank	-1.3	COAX	689 1400	Weapon:	HE-HI	Lock: UNLOCKED	Time:	6:15
		5.56	4719	Malf:		Dist: FRK	Sit:	6- 1

Sit No.	Bearing/ Weapon	Target Type	Tgt Range	Rounds TOW	Rounds 25mm	EST/ COAX	Projectile Impact Az	Projectile Impact El	Results
1- 1	R 98	HIND-D	1190	0	0	0			
	R 98 D	HIND-D	1202	0	0	0			
	R 98 D	HIND-D	482	0	0	0			
	R 103 D	HIND-D	1753	0	0	0			
2- 1	HE	TROOPS	1078	0	5	0	. . . . .		KILL - 40%
3- 1	5.56 MM	TROOPS	165	0	0	4	. . . . .		KILL - 30%
3- 2	5.56 MM	RPG	184	0	0	4	. . . . .		KILL - 100%
3- 3	5.56 MM	TROOPS	346	0	0	8	. . . . .		KILL - 60%
	L 8	BTR-70	701	0	0	0			
4- 1	L 0	BRDM-2	483	0	0	0			
	L 0 D	RPG	1205	0	0	0			
5- 1	L 18	TROOPS	1206	0	0	0			
	L 20	TROOPS	1192	0	0	0			

Status: Exercise Complete - Freeze Offensive Moving 37 mph

Crew Performance Analysis

Date:	9/25/97	Instructor: HARNISH, SKIP	Exercise: 498312
Vehicle :	2/21 B23	Commander: GODWIN	Time: 6:15
Position:		Gunner: KING	Sit: 6- 1

Sit No.	Bearing/ Weapon	Target Type	Time To Fire ID	Tgt Err	Hit/Miss Summary WM1	PL	FS	WM2
1- 1	R 98	HIND-D	-1.0<	0.0				
	R 98 D	HIND-D		0.0				
	R 98 D	HIND-D		0.0				
	R 103 D	HIND-D		0.0				
2- 1	HE	TROOPS	-1.0<	13.1	14.5(X)			
3- 1	5.56 MM	TROOPS	-1.0<	10.3	10.3(X)			
3- 2	5.56 MM	RPG	-1.0<	3.0	3.1(X)			
3- 3	5.56 MM	TROOPS	-1.0<	3.2	3.4(X)			
	L 8	BTR-70		0.0				
4- 1	L 0	BRDM-2	-1.0<	0.0				
	L 0 D	RPG		0.0				
5- 1	L 18	TROOPS	-1.0<	0.0				
	L 20	TROOPS		0.0				

TOTAL VEH TGTS: 6 KILLS: 0|TOW 0|25mm 0|COAX 0|5.56mm 0|40mm gr 0

TOTAL TRP TGTS: 7 KILLS: 4|TOW 0|25mm 5|COAX 0|5.56mm 16|40mm gr 0

Status: Exercise Complete - Freeze Offensive Moving 37 mph

Squad Summary

Date:	9/25/97	Instructor: HARNISH, SKIP	Exercise: 498312
Vehicle :	2/21 B23	Commander: GODWIN	Time: 6:15
Position:		Gunner: KING	Sit: 6- 1

SITUATION SUMMARY (seconds)

Sit	1st Tgt Active	Time of 1st Rnd	Time of Last Tgt Killed
1	7.6	0.0	0.0
2	>9.9	13.1	114.5
3	>9.9	10.3	159.9
4	>9.9	3.0	187.6
5	>9.9	3.2	243.3
6	>9.9	0.0	0.0
7	>9.9	0.0	0.0

	Cmdr/Gunr	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
Rounds	162	0	42	18	88	3	62
Hits	0	0	4	3	6	0	3
Kills	0	0	1	0	0	0	0

Status: Exercise Complete - Freeze Offensive Moving 37 mph